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ABSTRACT

A computerized system for analysis of the cost/benefits of public investment in vocational education program in the state of Florida was developed and pilot tested. The Bobitt procedure, developed at the University of Florida to assess the economic benefits of selected vocational programs, was revised and expanded to permit determination of benefit-cost ratios and internal rates of return for postsecondary and adult (preparatory) vocational programs in Florida school districts and community colleges. The sample for the study consisted of students completing postsecondary or adult vocational training in the licensed practical nursing, cosmetology, and air conditioning/heating mechanics program in selected Florida postsecondary vocational/technical schools and community colleges. The vocational education cost-benefit system generates three sets of output reports: two sets of reports providing detailed listings of the data included on the student master file and the program master file, and a summary of the major steps in the benefit-cost ratio and rate of return calculations. A review of the data indicates that the computerized system does, in fact, work and provides data by programs, institutions, and type of institutions. Accuracy of the data could be improved by increasing the number of individuals in the study; this should reduce the likelihood of unreliable fluctuations in both the benefit-cost ratios and rates of return. The report includes procedures for implementing the system, a summary report of the calculation of benefit-cost ratios and rates of return, and a bibliography. (KC)

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Final Report

Project No. DVE 9-1C11

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A Computerized System for Benefit-Cost Analysis in Vocational Education

Institute for Educational Finance
College of Education, University of Florida
Gainesville, Florida
1980

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Table of Contents

	Page
Preface	i
Chapter 1, Introduction	1
Chapter 2, Procedural Outline	33
Chapter 3, System Output Reports	44
Chapter 4, Pilot Test of System	55
Bibliography	74
Appendix A, Program Code Listing: Area Vocational Centers	
Appendix B, Program Code Listing: Community Colleges	
Appendix C, Florida Vocational Education Information System (FVEIS) Followup Survey	
Appendix D, Computer Implementation	
Appendix E, Computation Routines Logic	
Appendix F, Student Master File, Definitions and Sample Listing	
Appendix G, Program Master File	
Appendix H, Summary Report, Calculation of Benefit-Cost Ratios and Rates of Return	

Preface

Increased funding requests by educators must be justified to the public if they are going to be granted by legislators. Decision makers in the public sector must with efficiency in mind choose the alternative for which the gains to society exceed the costs by the greatest amount.

In 1963, with the passage of the Federal Vocational Education Act, each state was required to establish a state advisory committee for vocational education which would be responsible for evaluating the vocational programs within their state. In 1968, the Vocational Education Amendments to the 1963 Act were passed, and that reemphasized the requirements for evaluation on the part of the individual states and on the part of advisory committees within each state. As a result, the Federal government has become a strong supporter of cost-benefit analysis in education.

The Florida Department of Education is also interested in quantifying results of the educational programs, and the Division of Vocational Education has indicated a particular concern for benefit-cost studies by their recent efforts to introduce local vocational directors to benefit-cost analysis techniques by conducting special workshops and distributing Estimating Cost/Benefits Through Analysis: A Programmed Guide for Local Vocational Directors (Division of Vocational Education, April, 1977).

Since vocational and technical education program costs vary greatly between different programs, there is a need to link program benefits with program costs in order to make effective allocation decisions. School administrators who can demonstrate that additional funds will yield an

improved output are in a better position to have their appeals for increased appropriations granted than are those who argue simply that more resources are needed, but are unable to specify the expected outcomes.

The purpose of this study was to develop and pilot test a system for analysis of the cost/benefits of public investment in vocational education programs in the state of Florida. The Bobbitt* procedure, developed at the University of Florida to assess the economic benefits of selected vocational programs, was revised and expanded to permit determination of benefit-cost ratios and internal rates of return for post-secondary and adult (preparatory) vocational programs in Florida school districts and community colleges.

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*Lynne E. Bobbitt, Benefit-Cost Ratio and Rate of Return Analysis of Selected Programs in Florida's Post-Secondary Area Vocational Technical Center, Ph.D. Dissertation, University of Florida, 1978.

Chapter I

Introduction

Investment in human capital has been shown to be a major contributor to the economic productivity of a nation. An advanced and productive society must, of course, have as its foundation human resources which are capable of utilizing physical resources to their greatest and most efficient advantage. Each individual is a unit in one aggregate production process and contributes to the total gross national product. It is logical, therefore, to assume that vocational education will contribute materially to the well-being of both individual and society by increasing the productive capacity of those who progress through the various vocational education courses and programs.

The raw economic benefits of a comprehensive vocational education program make a compelling argument for further investment, both individually and by the state, but the essential test of the value of any program is to compare costs to benefits in order to truly and accurately determine the relationship between costs and benefits. Thus, it is important that a state establish a method or a system whereby it can measure the returns to its investment in any public program. The present project addresses this issue.

Background

It would not be incorrect to say that the idea of public investment is a relatively new idea for it was only in 1961 that the value of human capital in a nation's productivity was fully and clearly enunciated. Unde-

niably economists for at least 200 years have observed the importance of human resources in increasing productivity capacity. Adam Smith[1] realized this in an oblique way when he observed that:

> The acquisition of such talents, by the maintenance of the acquirer during his education, study, or apprenticeship, always costs a real expense, which is a capital fixed and realized, as it were, in his person. The improved dexterity of a workman may be considered in the same light as a machine or instrument of trade which facilitates and abridges labour, and which, though it costs a certain expense, repays that expense with a profit.[2]

Marshall[3] apparently accepted the idea of human capital but failed to include it in his definition of "wealth" and "capital" formation. Marx[4] of course indirectly stumbled into recognizing the importance of human capital in his discussion of surplus value where he tried to partition the laborers' contribution from the overall value of the final product. Keynes[5] readily ignored the issue in his General Theory. Actually, the value of human resources was not fully recognized nor given much credence by economists until Schultz observed in the early sixties that the economic productivity of nations could not be solely attributed to physical capital.[6]

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[1] A. Smith, The Wealth of Nations, 1776.

[2] Ibid., p. 24.

[3] R. Blandy, "Marshall on Human Capital: A Note," Journal of Political Economy 75 (December 1967): 874-875.

[4] F. L. Bender (ed.), Karl Marx, The Essential Writings (Harper & Row Publishers, New York, 1972).

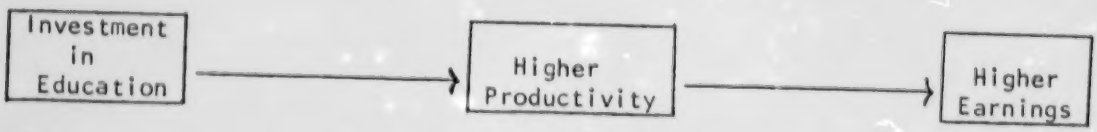
[5] J. M. Keynes, The General Theory of Employment, Interest, and Money, published 1935 (Reprint by Harcourt, Brace & Jovanovich, New York, 1964).

[6] T. W. Schultz, "Investment in Human Capital," American Economic Review 51 (1961): 1-17. (Schultz was awarded the 1979 Nobel Prize in Economic Science for his work in this field.)

Schultz's work set in motion further study and analysis which over the past generation have reasonably well delineated the economic value of investment in human resource development through education.

Scholars, such as Harbison,[7] have noted that the importance of human resources to economic productivity far exceeds most expectations, to the extent that the wealth of nation's may be more directly attributable to human than to physical resources.

Many studies have been conducted which verify the relationship between education and economic productivity. The model as Cohn[8] observes is quite simple:



As the individual acquires more education, he becomes more highly, individually productive and greater earnings will accrue to him. As individual earnings increase, the overall economic productivity of the state or nation benefits. "The basic premise of the human capital approach is that variations in labor income are due, in part, to differences in labor quality in terms of the amount of human capital acquired by the workers."[9]

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[7] Fredrick H. Harbison, Human Resources and the Wealth of Nations, (Oxford University Press, Oxford, 1973), p. 3.

[8] Elchanan Cohn, The Economics of Education (Ballinger Publishing Company, Cambridge, Massachusetts, 1979), p. 29.

[9] Ibid., p. 28.

Several methods have been used to verify the economic benefits of education. One such method developed by Denison is called the "residual approach" which is calculated by identifying the total increase in measurable inputs, both capital and labor, and then attributing the unspecified, residual inputs to education and advancement of knowledge.[10] Weisbrod[11] verified the work of Schultz and Denison pointing out that private benefits from education could be categorized into four broad areas: financial options, hedging options, nonmarket options, and direct financial returns. Accordingly, financial options gives the individual the opportunity to advance from one economic level to another, prepares one to advance the next financial step. The hedging option enables individuals to better adapt to new job opportunities or to technological change. Nonmarket options enables the educated person to perform certain personal tasks, e.g., filling out income tax forms, which an uneducated person cannot perform. Last, the direct financial returns are the monetary rewards received by a person as education improves the individual's job performance and, consequently, increases productivity and earnings.

The relationship between education and earnings has summarized by Innes, Jacobson, and Pelligrin as: (a) for males at all age levels, annual income increases as years of schooling increase (b) total lifetime income increases as educational attainment increases; (c) the favorable relationship between income and educational attainment has persisted through the years, even though the amount of formal schooling attained by the population

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[10] E. F. Denison, Accounting for United States Economic Growth, 1929-1969, Brookings Institution, Washington, D.C.

[11] B. A. Weisbrod, External Benefits of Public Education, Industrial Relations Section, Princeton University, Princeton, N.J., 1974.

has increased; and (d) when lifetime income is discounted or equated to the return on current investment, the contribution of additional education to earnings is positive and significant.

The most common approach used to calculate the benefits from education is the rate of return approach which simply contrasts the future lifetime earnings of people of less education with those of greater educational attainment.

The difference in lifetime earnings is usually expressed as a percentage rate of return on the costs incurred in acquiring the education. Analyses of income benefits to education utilize different methodologies, making comparison of results difficult. Miller[12] calculated lifetime income values by level of schooling, which gives a more or less gross measure of returns to education. Miller's method ignores the costs associated with obtaining an education.

The rate of return approach developed by Hansen[13] may be classified as cost-benefit analysis whereby the costs associated with education are estimated and deducted from the benefits, leaving a more precise estimate of the economic value of education. Of course, the key to the rate of return approach is an accurate determination of the costs of education. Two major variants exist in assessing costs. First are those indicating the total resource costs incurred by society in providing education, which include (1) school costs such as teachers' salaries, supplies, interest,

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[12]Herman P. Miller, "Annual and Lifetime Income in Relation to Education 1929-1959," American Economic Review 50 (1960): 962-986.

[13]W. Lee Hansen, "Total and Private Rates of Return to Investment in Schooling," Journal of Political Economy 81, no. 2 (1963): 128-141.

and depreciation on capital, (2) opportunity costs incurred by individuals, primarily from foregone income during school attendance and (3) incidental school-related costs such as books and travel.[14] Second are private resource costs, including the same basic components with tuition and fees paid by individuals substituted for the costs to society paid through taxation. Additionally, private rates of return usually indicate adjustments for taxation which will tend to shift benefits downward where progressivity of tax rates reduce the benefits of higher income levels.[15]

Opportunity costs or foregone earnings are the income the average student could have expected to earn had he been employed. Income foregone, of course, decreases rapidly toward the lower education grade levels, with income alternative below the eighth grade practically nonexistent. Since income foregone is such a substantial cost of education, the lower levels of education may show unusually high or even infinite rates of return.[16]

Using this methodological approach, Hansen found in 1963 that social or total resource rate of returns provided substantial justification for investment in education. Private rates of return, after taxes, were found to be in excess of alternative investments in physical capital. Schultz reached similar conclusions in summarizing rate of return studies for the National Educational Finance Project.[17] Of the several methods used to assess the returns to education, the rate of return method must be considered

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[14] Ibid.

[15] Ibid.

[16] Ibid.

[17] Theodore W. Schultz, "The Human Capital Approach to Education," Economic Factors Affecting the Financing of Education, ed. R.L. Johns et al. (Gainesville, Fla.: National Educational Finance Project, 1970), p. 48.

the most precise. It has the distinct advantage of not only analyzing economic benefits but also relating costs thereto.[18]

Rate of return studies, as devised by Hansen, have been generally accepted by economists as an accurate estimation of educational benefits because both sides of the equation, costs and benefits are taken into account. An explanation of the rate of return methodology and rationale is given by Psacharopoulos in Appendix A of this report.

The value of education to economic productivity of the individual and the states has not gone unchallenged. Shaffer early expressed his doubts pointing out that a student's education is not always selected to maximize income saying that:

> Any attempt to show that rational individuals tend to undertake expenditure on education up to the point where the process of education equals the rate of interest--a point at which the marginal expenditure on education yields a return equal to the return on marginal expenditure for any other factor of production--would be a mockery of economic theory.[19]

Shaffer further points out the difficulty in delineating between investment and consumption benefits. If the education is undertaken for nonmonetary reasons (e.g., to simply go and enjoy college life) then one cannot accurately estimate how much of the costs of college are attributable to investment. Bowen,[20] Blary,[21], too, caution concerning the importance

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[18]See: Kern Alexander, "The Value of an Education," Journal of Education Finance, Vol. 1 (Spring 1976): 433-434.

[19]H. G. Shaffer, "Investment in Human Capital: Comment," American Economic Review 52, no. 4 (1961): 1026-1035.

[20]W. G. Bowen, "Assessing the Economic Contribution of Education: An Appraisal of Alternative Approaches," Higher Education. Report of the Committee Under the Chairmanship of Lord Robbins: pp. 961-963, H.M.S.O. (1963): 73-96.

[21]Mark Blary, "An Economic Interpretation of the Private Demand for Education," Economics (May 1966): 168.

of this factor in precise calculation of rates of return. Blary pointed out that some of the apparent benefits of education may be attributable to other factors such as the native ability of the person acquiring the education, more intelligent people tend to seek more education and the benefits accruing thereto may be the result of this basic ability rather than to education. Blary estimated that about one-third of observed earning differentials may be attributable to native ability, social origins, and family environment." Hansen and Weisbrod have shown that about 25 percent of the observed differences in earnings between high school and college students may be attributable to factors of ability and motivation.[22] In a recent analysis Olneck[23] estimated that the percentage of bias in earnings attributable to ability was in the neighborhood of 16 to 33 percent.

Jencks[24] in a widely publicized study, Inequality, published in 1972, concluded that education had very little impact on earnings and that difference in economic states in our society was largely a matter of "luck." Later, in 1979, Jencks effectively reversed himself in another study entitled Who Gets Ahead, "Four years of high school are associated with a 40 percent increase in earnings . . ."[25] Four years of college are associated with a 49 percent earnings advantage . . ."[26]

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[22]W. L. Hansen and B. A. Weisbrod, Benefits, Costs, and Finance of Public Higher Education (Markham, Chicago, 1969).

[23]Michael Olneck, "The Effects of Education," Who Gets Ahead, Christopher Jencks et al. (Basic Books, New York, 1979), p. 182.

[24]Christopher Jencks et al., Inequality: A Reassessment of the Effect of Family and Schooling in America (Basic Books, New York, 1972).

[25]Christopher Jencks et al., Who Gets Ahead, supra.

[26]Ibid., p. 188.

Acknowledging the importance, then, of ability and social conditions, evidence indicates that education is a major contributor to economic productivity. If one simply compares mean earnings of individuals by educational level, without taking costs into account, an indication of the benefits is apparent. For example, the earnings of all males of all races over 18 years of age showed average earnings, in 1979, for the elementary dropout to be $9,770, for the elementary graduate to be $11,836, the high school dropout $12,678, high school graduate $14,600, college dropout $16,207, college graduate $20,966, and graduate, five years plus, $25,650. Such a broad average of the entire male population of the United States showing the relationship between education and earnings attests prima facie to the value of education.[27]

Table I summarizes several studies showing the rate of return to secondary schooling in the United States.

Vocational Education Studies

Vocational education is particularly receptive to measurement in benefit-cost analyses because it can be assumed that most of the costs are directed toward economic investment rather than consumption. This is not true, of course, of many other programs, such as music appreciation, ancient history, and seventeenth century poetry, which are likely to be untaken primarily for their consumption benefits and only secondarily as

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[27]U.S. Bureau of the Census, Current Population Reports, Consumer Income, Series P-60, March 1979, Table 48, p. 195.

Table I

Private and Social Rate of Returns to Secondary Schooling in the United States*

Author(s)	Sample Year	ROR (percent) Private	Social
Hansen (1963)	1950	14.5	11.4
Becker (1964)	1940	16.0	
	1950	20.0	
	1956	25.0	
	1958	28.0	
Hanoch (1967)[a]	1960	16.1	
Hines, Tweeten and Redfern (1970)[b]	1960	19.5	14.0
Mincer (1974)	1960	13.0	
Carnoy and Marenbach (1975)	1940	49.1	18.2
	1950	22.7	14.2
	1960	14.6	10.1
	1970	18.9	10.7

*Elchanan Cohn, The Economics of Education (Ballinger Publishing Company, Cambridge, Massachusetts, 1979), p. 115.

[a]Northern whites only.

[b]Male whites only; rates for other race-sex groups vary substantially.

an investment. Too, information about programs, courses, and costs provide a better basis for empirical analysis of vocational education than for other general subject matter of our schools and colleges. Beyond this vocational education is more often looked upon by legislators as, at least, the partial solution to high rates of unemployment. Such attributes have led to several studies of the value of vocational education as an economic investment.

The present project is a spin-off of the research undertaken at the University of Florida by Bobbitt in which she calculated the benefit-cost of selected vocational programs in Florida.[28]

Bobbitt found that graduates of the practical nursing program would earn a private benefit-cost ratio of $122,962 to $9,530 or 13:1. In other words, a graduate of this program will receive a net private benefit of $113,432 over a 33-year working lifetime, or a compounded annual marginal investment return of 8.06 percent. Graduates of air conditioning and heating mechanics were found to have a net private marginal rate of return of 12.64 percent.

The public benefit to investment in nursing yielded a marginal return of 3.70 percent while the marginal annual investment return for air conditioning and heating mechanics was 11.35 percent. These returns must be considered quite high since these figures reflect the marginal return beyond an expected 9 percent return which could be expected on any investment in physical capital.

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[28]Lynne E. Bobbitt, Benefit-Cost Ratio and Rate of Return Analysis of Selected Programs in Florida's Post-Secondary Area Vocational Technical Centers, Unpublished dissertation, College of Education, University of Florida, March 1978.

A well-known study was undertaken by Hu, Lee, Stromdorfer and Kaufman in which the vocational track in high school was compared to the academic track in schools of three large cities. They found a very high rate of return of 56.8 percent.[29]

Carroll and Ihnen[30] studied the economic aspects of technical education received by 45 graduates of a post-secondary school (Gaston Technical Institute, in Gastonia, North Carolina). Direct costs of technical schooling were obtained from school records on tuition, fees, costs of books and supplies, and from state budgets. Both foregone earnings during the period of schooling and income gain following the two years of schooling were estimated by comparing the earnings of Gaston Tech students with the earnings of a control group of an equal number of ability-matched high school graduates.

The objectives of their study included determining an estimate of the costs and returns of vocational education, computing private and social rates of return on investments in vocational education, and comparing the rate of return on investment in vocational education with the rate of return on investments in general education. By adding to projected income differences an estimated value of additional leisure, Carroll and Ihnen computed a rate of return on investments in vocational education of between 16.7% and 20.1%. This is somewhat higher than estimates of rates of return for four years of college education. Carroll and Ihnen explained this higher rate of return may be the result of the fact that more of the human capital

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[29]Hu, Lee, Stromdorfer, and Kaufman, A Cost-Effectiveness Study of Vocational Education, Institute for Research on Human Resources, Pennsylvania State University, University Park, Pa. (1969).

[30]A. B. Carroll and L. A. Ihnen, "Costs and Returns for Two Years of Post-Secondary Technical Schooling," Journal of Political Economy 75 (1967): 862-873.

created by post-secondary technical schooling is oriented toward tasks to be performed in a particular occupation and may thus be classified as a producer durable. Graduates of a four-year college program may have more courses which are not oriented directly toward their future occupation, but rather are related to consumption and cannot be measured in the marketplace.

Corazzini[31] conducted a study to measure the economic benefits of the vocational high school to the individual graduate and to the local community and to compare these benefits with the economic costs of maintaining the school. The benefit-cost evaluation made use of wage data from a sample of 12 firms in the Worcester, Massachusetts, labor market. All 12 firms were engaged in manufacturing and were primarily interested in hiring workers as machine operators. Wages paid by the firms to vocational school graduates and regular high school graduates were compared, and it was found that the two types of workers received almost identical starting wages. The vocational program was further evaluated in this study as an investment in dropout prevention, and, as such, it was found to be only marginally effective.

Taussig[32] conducted a study of vocational education in urban public high schools in New York City. The major finding reported in this study was the lack of apparent success of vocational training in increasing the market productivity of the graduates. Taussig pointed out one of the

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[31]A. J. Corazzini, "The Decision to Invest in Vocational Education: An Analysis of Cost and Benefits," Journal of Human Resources 3 (Supplement), (1968): 88-120.

[32]M. K. Taussig, "An Economic Analysis of Vocational Education in the New York City High School," Journal of Human Resources 3 (1968): 59-87.

factors explaining why the vocational training in the high schools did not produce good results is the irrelevance of the schools' criteria for what constitutes a successful program. Rather than placement and employers' ratings, Taussig feels a criterion for evaluation should be how much are employers willing to pay the schools to provide the vocational training. Due to present day job entry requirements unrelated to specific job duties, internal promotion policies, seniority practices, and the declining importance of traditional trades and crafts, Taussig observed that, "In the labor market of the future, the most realistic 'vocational' education may involve greatly increased emphasis on the mastery of complex literary and mathematical skills."[33]

Kraft[34] conducted what he entitled a cost-effectiveness analysis of vocational education programs in Florida. He used as his sample students enrolled in the radio and TV repair programs and those enrolled in the electronics program in a north Florida and a mid-Florida area vocational technical school. In terms of benefit, Kraft only considered the monetary public and private rate of return on investment, although he included a review of literature referring to both the monetary and nonmonetary returns on investments in education. Kraft reported that for the vocational school graduates sampled in this study, the private rate of return on educational investments was astonishingly high and that the public cost-benefit ratios indicated a positive rate of return. Due to the difficulty Kraft discovered in obtaining data to conduct his study, he emphasized that the conclusions must be treated with extreme caution.

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[33] Ibid., p. 31.

[34] R. H. P. Kraft, Cost Effectiveness Analysis of Vocational-Technical Education (Final Report), Florida State Department of Education, Tallahassee, Fla., 1969.

A similar study was conducted in 1971 to determine the economic returns from vocational education in Florida. Harris[35] reported that this study was larger in scope, more sophisticated in methodology, and had a better data base than the earlier study. The state of Florida was divided into four different geographic areas and area vocational technical centers were randomly selected in each area. A questionnaire was mailed to a random sample of graduates of four programs in the selected area vocational centers. Two of the programs were practical nursing and air conditioning and heating mechanics. Based on a 49.5% return of questionnaires from practical nursing graduates, the following was computed: average private benefit of $1,056, average private cost of $2,823, average public benefit of $1,252, and average public cost of $2,078. Based on a 31 percent return from air conditioning and heating mechanics graduates, the following was calculated: average private benefit of $2,230. average private cost of $1,983, average public benefit of $2,646, and average public cost of $1,312.

A discount rate of 10 percent was selected for this study. Harris[36] reported a private rate of return for practical nursing of 33 percent and for air conditioning and heating of 150 percent. A public rate of return for practical nursing was reported as 51 percent and the public rate of return for air conditioning and heating mechanics was 263 percent. The difference between the net wage rates for skilled workers and the net wage rates for unskilled workers represented the net benefits resulting from

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[35]M. A. Harris, Benefit-Cost Comparison of Vocational Education Programs Statewide Evaluation of Vocational-Technical Education in Florida, Vol. 2, ERIC No. 074 223, 1972.

[36]Ibid., pp. 74-75.

vocational education in this study. One of the conclusions of this study was:

> The benefit-cost profiles which were constructed indicated that rates of return from investment in each of the four selected vocational education programs were positive and significant. . . . These findings suggest that promotion and expansion of vocational education in Florida would be a wise economic investment.[37]

Schriver and Bowlby[38] analyzed the Tennessee Area Vocational Technical School (AVTS) System in an attempt to determine an economic justification for vocational training, wage differences between the vocationally trained and nontrained, and the internal rate of return to area vocational technical training. They compared a sample of AVTS students with a control group of their high school cohorts matched as closely as possible except that the high school students did not attend AVTS or enter college immediately after graduation from high school.[39] Some of the findings reported in their study[40] include: (a) AVTS training resulted in average direct and indirect benefits of $7.02 per week, (b) that the vocational training reduced unemployment, increased labor force participation, and increased occupational mobility, (c) the total rate of return on investments in AVTS training during the period studied was estimated to be 6.3 percent, the private rate of return was estimated to be 13.4 percent, (d) students with the lowest educational ability received the greatest rate of return from AVTS training based

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[37] Ibid., p. 86.

[38] W. R. Schriver and R. L. Bowlby, The Effects of Vocational Training on Labor Force Experience. An Analysis of the Tennessee Area Vocational Technical School System, Memphis State University, Memphis, Tennessee, ERIC No. 051 388, 1971.

[39] Ibid., p. 62.

[40] Ibid., p. ix.

upon analysis of Social Security earnings, and (e) AVTS training was beneficial to former students regardless of prior educational attainment. The income of grade school dropouts, grade school graduates, high school dropouts, and high school graduates tended to be increased in a constant ratio.

Scott, Harris, Daniels, and Rawson[41] conducted a cost-benefit study of the vocational education programs in Kansas. As a result of their extensive study, they concluded:

> The training conducted in Kansas' fourteen area vocational and technical schools apparently has not returned the monetary investment society has made. This does not imply that certain programs are not a sound investment or that the total training mix could not be restructured to be a sound investment. It does imply that, with a pretraining expected annual productivity of $5,885.00 and a post training expected annual productivity of $6,012.00, the average successful trainee could not work long enough to reimburse society's original investment of $7,418.00 (program costs plus foregone productivity).[42]

The authors expanded on the above conclusion by stating several variables which could be adjusted to decrease the payback time and thereby make the possible training mixes better investments: (a) place emphasis on training programs where expected productivity is relatively high, (b) improve placement rates to decrease costs per successful trainee, and (c) shorten the length of training periods to improve productivity.[43]

Conroy[44] reported on a study conducted by the State Board of Education in Massachusetts to identify the relationship between lifestyles of graduates

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[41] R. E. Scott, J. L. Harris, R. B. Daniels, and W. Rawson, Kansas Manpower Utilization System for Training (K-MUST): Final Report (vol. 2 supplemental studies). Document Reproduction Service, Topeka, Kansas, No. ED 010 072, 1973.

[42] Ibid., p. 441.

[43] Ibid.

[44] W. G. Conroy, Jr., "Secondary Voc Ed Measures Up as Positive Investment," American Vocational Journal 51(8), 1976: 44-46.

post-secondary and adult (preparatory) vocational programs in Florida school districts and community colleges.

3. Pilot test the system, determining the benefit-cost ratio and private and public internal rate of return for a selected sample of programs in school districts and community colleges.

4. Compare the rate of return from an investment in vocational education to the rate of return presently available on alternative forms of capital investments.

Summary Statement of Procedures for Project

The sample for the study consisted of students completing post-secondary or adult vocational training in selected programs in Florida's post-secondary vocational technical schools and community colleges.

A procedure was developed to assess relevant information from the Florida Division of Unemployment Compensation to ascertain individual costs and returns, by identifiable vocational programs.

Private Benefits

The private benefits measured in this study consisted of the difference between the students' earnings prior to the vocational training and the actual earnings during the first year after completing the vocational programs, plus a projection of lifetime earnings. The lifetime earnings projections included adjustments for:

1. The historical productivity factor associated with each occupation or classification.

2. An inflation factor.

3. Work life expectancy tables.

of secondary vocational technical programs and graduates of secondary academic programs. In the summer of 1975, the lifestyles of a random sample of 2,600 vocational technical and general academic program 1969 and 1973 graduates were examined. Six years of post-secondary lifestyles for the 1969 class and two years for the 1973 graduates were studied. Conroy reported[45] that male trade and industrial students graduated in 1969 who did not go on to post-secondary school made an annual salary that was $1,378 higher (in 1975 dollars) than that of non-vocational male students who did not attend post-secondary school. It was estimated that this additional income per graduate times the approximately 7,700 trade and industrial graduates per year in Massachusetts totaled over $31 million in additional earnings, which should generate around $8 million in additional taxes annually.

Purpose of Present Project

The problem of the project was to develop and pilot test a system for calculating the direct economic benefits to the individual and to society and the costs to the individual and to society for post-secondary and adult (preparatory) area vocational programs in Florida's school districts and community colleges to determine the benefit-cost ratio and internal rate of return for each program. Sub-problems of the project were to:

1. Further develop the Bobbitt procedure for measuring the direct and indirect costs and benefits to the individual and to society.

2. Develop a system based on the revised Bobbitt methodology for determination of the cost-benefit ratios and internal rates of return for selected

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[45] Ibid., p. 46.

4. Survival ratios based on the total population of Florida.

5. An interest rate to compute the present value of the work life projections.

Public Benefits

Direct public benefits were measured in this study by the marginal difference in Federal, State, and local taxes estimated on the work life earnings of the vocational graduates, and the taxes estimated over a work life based on their average prior earnings.

Projections of Federal income tax payments to be made over the work life of the graduates were made on the basis of the rate applicable on the 1977 earnings for a single individual with no dependents. After computing the appropriate tax on the 1977 earnings, the percentage of gross income that tax represents will be determined. This percentage rate were then applied to each year's gross income to determine the estimate of the Federal tax due.

Estimates of State tax payments were made on the basis of the study performed by Lile[46] in which he estimated that families in Florida with an adjusted gross income of $5,000 pay a state and local tax burden of approximately 7.5 percent of their gross income, and families with income of $7,500 pay approximately 6.0 percent state and local taxes on their gross income.

Indirect public benefits measured in this study were based on the multiplier effect. A multiplier of five times the net increase in gross earnings will probably be used to approximate the total effect the graduates' increased earnings had on the entire economy.

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[46]S. E. Lile, Family Tax Burdens Compared Among States and Among Cities Located Within Kentucky and Neighboring States (Kentucky Department of Revenue, Frankfort, Kentucky, 1975), p. 46.

Private Costs

In calculating the direct private costs of the vocational training, the actual costs were used as reported by the Division of Vocational Education for: (a) registration, tuition, shop, and materials fees; (b) cost of books; (c) cost of supplies; and, (d) cost of uniforms or other special clothing required.

Indirect private costs were calculated for income foregone by the students while not participating in the labor market.

Public Costs

Cost data reported on the Annual District Financial Report (PC 4) were computerized and utilized by the Division of Vocational Education to determine the cost per completing student for each of the surveyed programs. Five steps were utilized to determine the cost per student:

1. Determination of total operating budget costs per course.
2. Determination of total equipment depreciation costs per course.
3. Determination of student enrollment per course.
4. Computation of course cost per student.
5. Computation of program cost per student based on summation of course costs for the courses included in a model program for each program area as determined by the Division of Vocational Education.

Rationale for Factors in Calculations

In order to determine one rate of return to investment one must develop a reasonably accurate method for measuring costs and benefits. In this study, costs were ascertained by a combination of data collected from a

central information center and from questionnaire. More detail concerning costs are given later in this report. Concerning benefits' lifetime income, the problem is somewhat more difficult to resolve. In accordance with the Hansen[47] model of rate of return analysis several factors must come into play in estimating lifetime income, including: rate of productivity increase, age earnings cycies, and discount rates and the economic multiplier effect.

Our assumptions in this report effectively constitute a second stage of the Bobbitt study and we have therefore with few exceptions followed the same rationale. The following discussion is from the Bobbitt study, effectively summarizing the rationale for selection of the various calculation factors.

Lifetime Income*

Lifetime income estimates are a measure of the incomes that could be expected on the average by members of specific education groups in a lifetime or for any specified span of years.

The formula used by the Department of Commerce to compute estimates of the present value of expected income from any given age through age 64 is as follows:

$$V_A = \sum_{N=A}^{64} \frac{Y_N P_N (1 + X)^{N-A+\frac{1}{2}}}{(1 + R)^{N-A+1}}$$

Where,

V_A = The present value of the total sum of income received between a given age A and age 64.

Y_N = The average (mean) annual income at age N.

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[47]Hansen, supra.

*From Bobbitt.

P_N = The relative number of survivors at age N of those alive at age A.

X = Assumed annual increase in income due to rising productivity. Four different values are used: 0 percent, 2 percent, 3 percent, and 4 percent. This factor adjusts for the growth in the economy, not for the inflation of prices.

R = The rate of discount used to convert future income to their present values. Four different rates of discount are used: 0 percent, 3 percent, 5 percent, and 7 percent.[48]

National projections of lifetime income reported by the United States Department of Commerce do not consider increases in income due to inflation (the general upward trend in prices), nor do they take into consideration the fact that a person's productivity varies at a different rate over a person's lifetime, nor do they incorporate work life expectancy data.

Productivity Factor*

At any given period in time, earnings of individuals in virtually all occupations are a function of the age of the individual worker. This is due to factors such as experience and seniority, which affect individual productivity, and the average number of hours worked. Each occupation has its own age-earnings or productivity cycle, and such profiles can be constructed from census data for most occupations.

> Although such curves may vary slightly from occupation to occupation, all have a remarkably similar shape. Annual earnings increase rapidly in the early ages of employment, level off during middle age, and decline sharply after 55. Such a profile is the result of increasing productivity into the middle age of the average individual and, later in life, of declining

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[48] Annual Mean Income, U.S. Department of Commerce, March, 1974, p. 9.

*From Bobbitt.

> productivity and shorter hours of work. (Bassett, Miller, & Schall, 1971, p. 7)

In evaluating the benefits received by individuals completing a one-year vocational program, it is necessary to look at more than the earnings received during the first year after completing the training. Many vocational graduates enter the job market at entry levels of pay. True earnings benefits resulting from their training are not realized for several years. For this reason, projections of lifetime earnings should be based on the historical productivity factor associated with earnings for the particular occupation or classification of worker.

This concept is consistent with Miller's[49] computations of lifetime income in relation to age and education. Miller found that advantages of additional years of schooling did not have a very strong immediate impact on earnings. Inexperienced workers in most occupations started at a relatively low level of earnings, but their earnings tended to increase as skill and experience were acquired.

> Therefore, the financial benefits of additional schooling tend to accumulate over time, and the greatest impact is felt during the period of peak earnings. . . . In each education group the period of maximum earnings is between 45 and 54 years of age.[50]

Productivity indices are calculated to adjust for the growth in productivity in the economy. "In a growing economy, every individual may expect an upward trend in his own earnings superimposed on the cross-sectional pattern for a particular year."[51] This represents an adjustment for the

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[49] H. P. Miller, "Annual and Lifetime Income in Relation to Education 1939-1959," American Economic Review 50 (December 1960): 962-986.

[50] Ibid., p. 973.

[51] H. S. Houthakker, "Education and Income," The Review of Economics and Statistics 41 (February 1959): 24-28.

growth in productivity, not for the inflation of prices.

The United States Department of Commerce calculates the productivity factor at four different values: 0 percent, 2 percent, 3 percent, and 4 percent.[52] However, the Department of Commerce does not take into consideration the fact that a person's productivity varies at a different rate over the person's lifetime.

The 1970 census data reported by the United States Department of Commerce[53] indicate that the mean earnings for female workers in the state of Florida with a four year high school education increases on the average of 3.32 percent between the ages of 24 and 34, increases 1.37 percent between the ages of 35 and 44, increases 0.88 percent between the ages of 45 and 54, and then decreases between the ages of 55 and 64 by 0.94 percent. These data represent the latest information available regarding specific incomes related to age and level of education for females in the state of Florida.

The productivity or age-earnings cycle for practical nurses can be determined through a survey of personnel directors in hospitals. A telephone survey of personnel directors in 12 hospitals in Dade County revealed that the majority of the hospitals pay a high annual percentage increase (4.5%) in salary during the first five years of employment. Annual salaries are increased approximately 2 percent for the next five years of employment, and then annual salaries increase at approximately 1.5 percent per year after the first 10 years. Salaries tend to level off between the ages

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[52] Annual Mean Income, U.S. Department of Commerce, 1974, p. 9.

[53] Census of the United States, 1970, U.S. Department of Commerce, April 1973, pp. 11-1219.

of 55 and 64 (collected for Bobbitt Study).

Data reported by the U.S. Department of Commerce regarding 1975 national income for male high school graduates indicate that mean earnings increase between ages 24 and 34 by 7.68 percent, increase between ages 35 axn 44 at a rate of 1.99 percent, increase between ages 45 and 54 at a rate of 0.72 percent, and decrease between the ages of 55 and 64 at a rate of 1.01 percent.[54]

Air conditioning and heating mechanics' salaries increase at a rate of 6.4 percent to the age of 43, increase at a rate of 2.85 percent for the next 10 years, and from the ages of 54 to 64 there is little or no growth in annual wages.[55]

The analysis of growth in earnings from 1967 through 1975 indicated that the average annual rate of increase in earnings for both male and female high school graduates was approximately 5.5 percent.[56]

Historical data for licensed practical nurses in the South indicate their average wages have risen at a rate of approximately 8.5 percent over the last 13 years (All Hospitals: Occupational Averages, 1964, p. 11; Earnings Distribution: Licensed Practical Nurses, 1977, p. 82). This large percentage increase contrasts with the historical average annual percentage increase for all workers over the last 25 years of approximately 5.5 percent. People in any industry cannot expect to be more successful at protecting themselves against inflation than the workers in any other

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[54] Income in 1975, U.S. Department of Commerce, 1977, p. 199.

[55] Median Annual Earnings, 1976, U.S. Department of Commerce, p. 58.

[56] Income in 1967, and Income in 1975, U.S. Department of Commerce, 1968, p. 17, and 1977, p. 204.

industry. The licensed practical nurses have, however, been more successful in receiving higher annual percentage increases in salary than the typical high school graduate. However, it seems highly unlikely that this high annual percentage increase will be sustained in the future. The rate of 5.5 percent conservatively projects the future general trend in licensed practical nurse salaries.

Historical data for specific wages for air conditioning and heating mechanics were grouped with wage information for workers in other industries. However, data for electricians and plumbers (the closest related occupations) indicate an annual percentage grwoth rate in salary of between 7.67 percent and 6.88 percent over the last 14 years.[57] Therefore, projecting annual percentage increases for air conditioning and heating mechanics at the same rate as the previous three classifications of wage earners would seem to constitute a conservative projection.

Work Life Expectancy*

In evaluating lifetime income, it is necessary to establish how long an average individual with certain characteristics will work. Typically, the assumption is made that the average individual will work all his life, or, at least, to age 65. If the first assumption is utilized, a standard life expectancy table could be used to project, for any given age, the average individual's life expectancy. The facts do not support the use

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[57]"Union Hourly Wage Rates and Employer Insurance, Pension, Vacation and Other Fund Payments for Selected Building Trades in 121 Cities, by Census Geographic Division, July 1, 1976," Construction Review, 22(8): 50-51.

of either average life expectancy or age 65 as the appropriate factor for calculating the length of the average individual's working life. The use of either of these figures leads to an exaggerated estimate of lifetime income. More accurate projections are based on work life expectancy tables.[58] The Department of Labor has constructed such tables from the data contained in the 1940, 1950, and 1960 censuses.

Fullerton and Byrne[59] reported that data from the 1970 working life tables indicate that since 1960 the work life expectancy has continued to edge downward for men and to lengthen for women. At the age of 30, men are expected to work an additional 32.3 years, and women are expected to work an additional 32.6 years. At the age of 35, men are expected to work an additional 27.6 years, and women are expected to work an additional 28.5 years.

Present Value

A problem arises in evaluating projects due to the fact that benefits and costs accrue in different time periods. Haveman[60] stated the problem exists because of a very basic proposition: "A dollar of benefits (or costs) not expected until next year, is worth less than a dollar of benefits (or costs) expected today."

To be accurate in benefit-cost analysis, dollars must be stated in terms of the same date. It has become common practice to state costs and

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[58] L. R. Bassett, R. L. Miller, and L.D. Schall, "The Use of Economists by Defense," Practice & Procedure 2 (1971): 5-20.

[59] H. N. Fullerton and J. J. Byrne, "Length of Working Life for Men and Women, 1970," Monthly Labor Review 99(2) (February 1976): 31-33.

[60] R. H. Haveman, The Economics of the Public Sector (John Wiley & Sons, New York, 1970), p. 158.

benefits in terms of their present value. The value of a dollar depends on when you will gain or will lose use of it. A dollar placed in savings at a 5 percent rate a year ago has become $1.05 today and will become $1.1025 next year. On the other hand, a dollar not expected until next year is worth about 95¢ today if the interest rate is 5 percent. Therefore, the time of investment is all important.

The present value of any given future income is equal to the amount of money which must be invested today at a certain interest rate in order to yield that given income in the future. Since it is possible to invest today in order to have a larger capital sum later on, future earnings must be discounted by some appropriate interest rate.

There is no consensus on what constitutes the appropriate interest rate to compute the present value of lifetime incomes. The United States Department of Commerce computes expected lifetime incomes at discount rates of 0 percent, 3 percent, 5 percent, and 7 percent. Weisbrod[61] suggested a discount rate of 10 percent, and Harris[62] also used a 10 percent rate in his Florida benefit-cost study. Webb[63] referred to a discount rate of 5 percent as being what the review of literature suggested as most appropriate.

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[61] B. A. Weisbrod, "Conceptual Issues in Evaluating Training Programs," Monthly Labor Review 89 (October 1966b): 1009.

[62] M. A. Harris, Benefit-Cost Comparison of Vocational Education Programs. Statewide Evaluation of Vocational-Technical Education in Florida, Vol. 2, Florida State University, Tallahassee, Florida (ERIC No. 074 223).

[63] L. D. Webb, The Development of a Model to Measure Selected Economic Externalities of Education, Unpublished Doctoral Dissertation, University of Florida, Gainesville, 1975.

It, therefore, seems appropriate to use as a ciscount factor that rate which could be earned on tax free instruments as opposed to a rate that could be earned on taxable instruments from corporate or Federal issues.

Multiplier Effect

Increased personal incomes have a multiplier effect on the level of the national income, and the magnitude of this additional public benefit can be calculated by applying macro-economic multipliers to the individual benefits.

The consumption multiplier describes the effect on total personal income that comes from the introduction of a given increment of income for a particular worker. A portion of the additional income will be used to satisfy the worker's consumption needs. This spending will in turn become earnings for those who serve as suppliers of goods and services for the worker. The proportion of additional income generated in a single round of spending is the factor which must be ascertained in order to calculate the multiplier effect.

Calculation of the multiplier is extremely difficult. An exact quantification of its value would be possible only through an item-by-item analysis of the income receipts and expenditures of each consumer.

The theoretical implications of the multiplier formula were first recognized by Keynes, who stated that a fundamental psychological rule of any modern community is that an increase in total income does not lead to the same increase in consumption. The multiplier formula expresses the same thing as the marginal propensity to consume, and informs us how an increment in income will be divided between consumption and investment.

Kastner[64] attempted to compute returns on an investment in public community colleges for both the individual and society in terms of 1974 dollars. For his study, he made the following assumption: "The marginal propensity to consume is positive and equal to four-fifth" (p. 22). Based on this assumption and several others, Kastner used a multiplier of five to multiply times the mean marginal gross income to reveal a gross societal return for an investment in public community colleges.

The multiplier effect is based on the marginal propensity to consume. Data published by the United States Department of Commerce[65] indicated consumers' personal consumption expenditures equaled 79.4 percent of personal income in 1972, 78.6 percent in 1973, 78.5 percent in 1974, and 78.7 percent in the first quarter of 1975. Personal expenditures for the second quarter of 1977 were 80.49 percent of total personal income.[66] The data indicate the national average propensity to consume is approximately four-fifths. A multiplier of five would approximate the total effect an increment in personal income would have on the entire economy.

Benson[67] justified public support of education because education provides substantial social, as distinct from private, benefits. As education

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[64]H. H. Kastner, "Cost/benefit Analysis of Community College Education," Community College Review 4(3) (Winter 1976): 17-26.

[65]General Business Indicators, U.S. Department of Commerce, May 1975, p. 5-2.

[66]Personal Income and Savings, U.S. Department of Commerce, 1977, p. A53.

[67]C. S. Benson, The Economics of Public Education (2nd ed.) (Houghton Mifflin, Boston, 1968), p. 47.

produces higher earnings for the individual, national incomes rise. "Hence, expenditures on education can properly be regarded as an investment that leads to growth in national income, or, to say the same thing, school expenditures stimulate economic growth."

Chapter 2

Procedural Outline

The present project developed a system which would enable the Division of Vocational Education to conduct periodic benefit-cost studies of selected post-secondary and adult vocational programs. The project was to develop and pilot test a system for calculating the direct economic benefits to the individual and society and the costs to the individual and to society for post-secondary and adult area vocational education program in Florida's Community Colleges and school districts. The product of the system is to provide benefit-cost ratios and internal rates of return for each program examined.

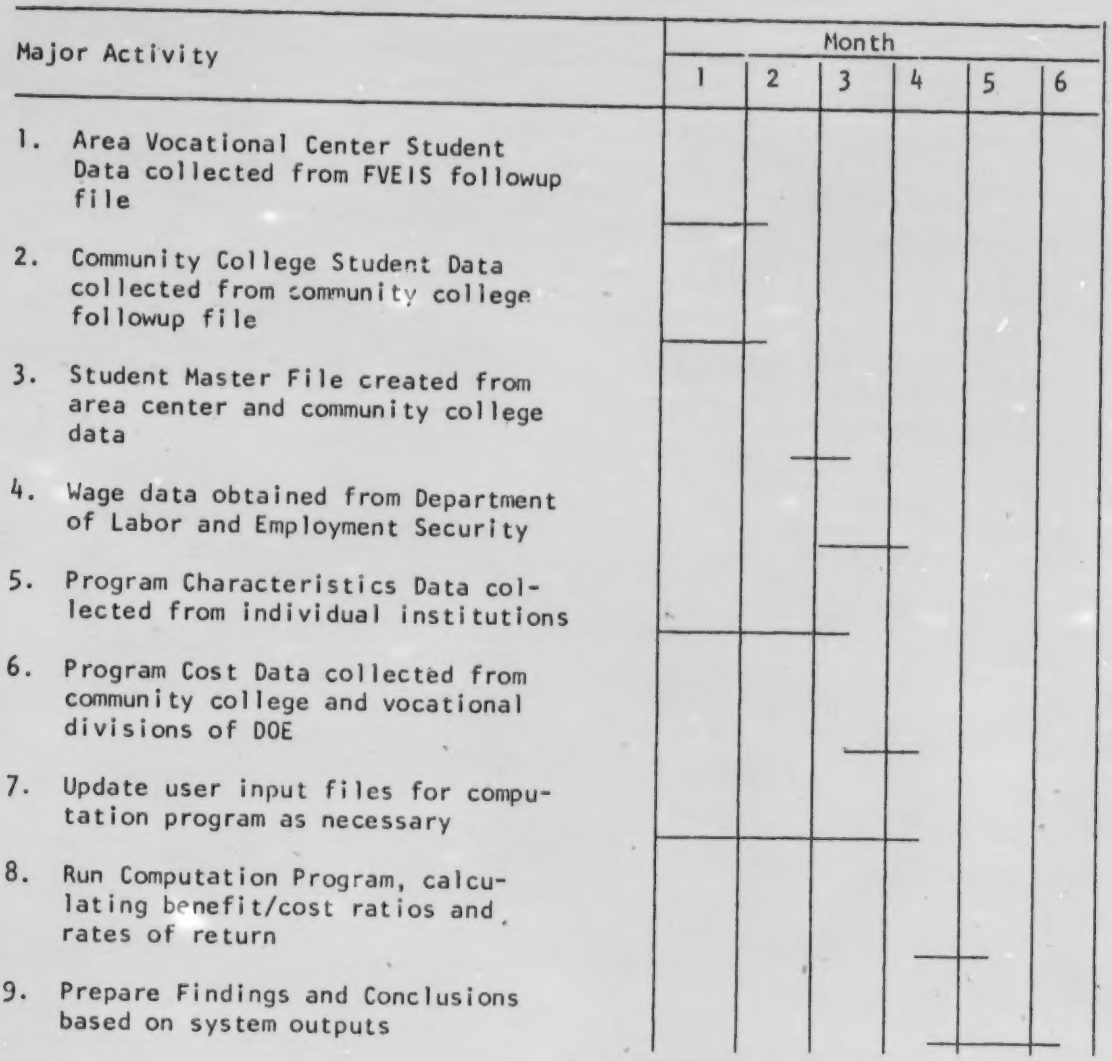
The sample for the study consisted of students completing post-secondary or adult vocational training in the Licensed Practical Nursing (LPN), Cosmetology, and Air Conditioning/Heating Mechanics programs in selected Florida post-secondary vocational/technical schools and community colleges. Individual student data were obtained from the Florida Vocational Education Information System (FVEIS) followup file and the Community College Placement and Followup System. These data were passed against the wage files of the Department of Labor and Employment Security to determine earnings before, during and after training. Direct private cost data were collected from the selected institutions, and direct public cost data were obtained from program cost reports of the Department of Education. The focus of the study was on the development and pilot testing of an automated system utilizing existing data sources for the computation of benefit-cost ratios

and rates of return to investment in selected vocational education programs in Florida.

The system developed requires approximately six months turn-around from the beginning of a study of benefit-costs to the final output. Operating within this time-frame, the system may be implemented following the nine step sequence indicated in Figure 1. Each of the steps in the process is outlined below. A detailed description of the items included in each of the files is given.

FIGURE I

Vocational Education Cost-Benefit System
Gantt Chart


Major Activity
Month
1
2
3
4
5
6
1. Area Vocational Center Student Data collected from FVEIS followup file
2. Community College Student Data collected from community college followup file
3. Student Master File created from area center and community college data
4. Wage data obtained from Department of Labor and Employment Security
5. Program Characteristics Data collected from individual institutions
6. Program Cost Data collected from community college and vocational divisions of DOE
7. Update user input files for computation program as necessary
8. Run Computation Program, calculating benefit/cost ratios and rates of return
9. Prepare Findings and Conclusions based on system outputs

Vocational Education Cost-Benefit System
Outline of Recommended Procedures

I. Area Vocational Center Student Data collected from Florida Vocational Education Information System (FVEIS) followup file.

A. User completes request for individual student data from FVEIS followup file.

1. Request is directed to Management Information Systems (MIS) Coordinator, Vocational Division, Florida DOE.

2. The following information is specified in the data request:

a. Academic year of program completion.

b. Program names and 4-digit program codes included in study (see area vocational center program code listing, Appendix A).

c. Individual student records should be provided on computer tape with accompanying documentation.

d. A listing of the student records, sorted by program by institution, should be provided.

B. Vocational Division MIS Coordinator makes arrangements with FVEIS data processing staff for completing the request for individual student data from the FVEIS followup file. Processing is completed and outputs are returned to user.

II. Community college student data collected from community college followup file.

A. User completes request for individual student data from Division of Community College's Placement and Followup System.

1. Request is directed to Bureau Chief, Bureau of Research and Information Systems, Community College Division, Florida DOE.

2. The following information is specified in the data request:

a. Academic year of program completion.

b. Program names and 8-digit ICS program code (see community college program code listing, Appendix B).

c. Individual student records should be provided on computer tape with accompanying documentation.

d. A listing of student records, sorted by program by institution, should be provided.

B. Community College Division Research and Information Systems Bureau Chief completes arrangements for processing the data request. Outputs are returned to user upon completion of data processing.

III. Student Master File created from area vocational center and community college data.

A. User spot-checks listings of area vocational center and community college student data to verify that the correct programs have been included and that other data elements appear to be in order.

B. User makes determination regarding institutions to be incorporated in study sample. All institutions with the selected programs or a sample of these institutions may be included in the study.

C. User requests that data processing activities necessary for creation of the student master file be completed. This request should include the following information:

1. A listing of specific institutions to be included in the study. Institution name and FICE code should be provided for community colleges; institution name, county number, and institution number for area vocational centers. A detailed listing of institutions is necessary only if all community colleges and area vocational centers with the specified programs are not to be included in the study.

2. Statements created for the student master file.

3. The FVEIS and community college computer tapes and accompanying documentation.

D. The data processing staff creates the student master file.

IV. Wage Data obtained from Department of Labor and Employment Security.

A. User contacts Director of Caldwell Data Center, Florida Department of Labor and Employment Security, to schedule computer time for passing student social security number file against Department of Labor and Employment Security wage file.

B. User requests that data processing create tape file of social security numbers from student master file to be passed against Department of Labor and Empioyment Security Wage file.

C. Data processing creates student social security number tape in format required by Department of Labor and Employment Security.

D. User forwards request for data processing services and student social security number tape to Director of Caldwell Data Center. Request for data processing services includes the following information:

1. Quarters for which data are requested. Two consecutive quarters should be specified by the user for each of three academic years: the year before training, the year during training, and the year after training. In the pilot test of the vocational cost-benefit system, for example, quarters selected for cost-benefit analysis of 1976-7 programs were: (a) 1975-4th Quarter and 1976-1st Quarter for pre-training period, (b) 1976-4th Quarter and 1977-1st Quarter for training period, and (c) 1977-4th Quarter and 1978-1st Quarter for post-training period.

2. A list of student social security number tape characteristics as required by the Department of Labor and Employment Security including: (a) 80 character record, (b) social security number in columns 38-46, sorted in ascending order, (c) 1600 BPI, (d) IBM standard labels, and (e) block size.

3. A dump of the student social security number file.

E. Caldwell Data Center staff completes data processing request and returns student social security number tape and a tape with student social security number-wage record matches to user.

V. Program Characteristics Data collected from individual institutions.

A. User initiates request for the following data from vocational staff of each institution included in the sample:

1. Academic year for which data are being collected.

2. Total cost of tuition and fees per student for entire period of program.

3. Total cost of uniforms, books, and supplies per student for entire period of program.

4. Course names and numbers making up the program and student contact hours of each.

5. Average age of program completers.

6. Average financial aid per student in the form of grants.

7. Typical program length in months.

B. User follows-up on data requests as necessary to obtain appropriate data from all selected institutions.

C. Vocational staff of each institution provide user with requested data.

VI. Program Cost Data collected from Community College and Vocational Divisions of Florida DOE.

A. User requests cost data for courses making up the selected programs at community colleges from the Chief, Bureau of Financial and Business Services, Division of Community Colleges, Florida DOE. Data request specifies:

1. Fiscal year.

2. Course names and numbers.

3. Institution names and numbers.

4. Provide actual expenditure data and equipment depreciation estimate.

5. Provide expenditure data on a per FTE basis.

B. User requests cost data for courses making up the selected programs at area vocational centers from the Coordinator, Management Information Systems, Vocational Division, Florida DOE. Data request specifies same information as that for community colleges.

C. The requested cost data are supplied to the user.

VII. Update User Input Files for Computation Program as Necessary.

A. The vocational education cost-benefit system requires that the user provide certain basic data necessary for computing the cost-benefit ratios and rates of return. These data are included on three files:

1. Decision File

2. Program-Standard Industrial Classification (SIC) Code Match File

3. Program-By-Institution Data File

B. Decision File

1. Through the decision file, the user specifies a set of factors which control the procedures used to compute the benefit-cost ratios and rates or return. Some of these factors reflect policy decisions made by the user concerning calculation procedures, and may be changed at the discretion of the user. Other factors must be updated periodically to reflect changes in inflation rates, tax rates, or other economic conditions included in the model.

2. The items included in the decision file are listed below. Specific values used in the pilot study are discussed in Chapter 4 of this report.

D100 - Minimum number of weeks worked by an individual during the two-quarter pretraining and post-training data collection periods for the individual to be classified as having valid wage data. This factor may be varied at the discretion of the user from a minimum value of one to a maximum value of twenty-six, the total number of weeks within the respective two-quarter data collection periods.

D101 - Minimum weekly wage within the two-quarter data collection periods before and after training for an individual to be classified as having valid wage data. This factor may be modified at the discretion of the user.

D102 - Maximum weekly wage within the two-quarter data collection periods before and after training for an individual to be classified as having valid wage data. This factor may be varied at the discretion of the user.

D103 - Pretraining wage assumed under the full employment model for an individual whose wage data is not classified as valid. This factor may be varied at the discretion of the user.

D104 - Inflation update factor for one year program, bringing pretraining wage rates up to the post-training equivalent value in current dollars. This factor should be modified annually to equal the ratio of the Consumer Price Index (CPI) at the time of the post-training date collection period to the CPI at the time of the pretraining data collection period.

D105 - Inflation update factor for alternate length program. This factor should be used if some programs under study require more than one year of training. In such a case, the pretraining wage data would be for an earlier time period than is the case with a one year program, and the inflation factor should reflect the ratio of the CPI during the post-training data collection period to the CPI during the earlier pretraining period. This factor is used in the computation program only if the training program length specified by the user (P102 in Program-by Institution Data File) is greater than 1.1 years.

D106 - Post-training weekly wage assumed for an individual whose wage data is not classified as valid. May be varied at the discretion of the user.

D107 - Inflation update factor to bring training period salary up to post-training period equivalent in current dollars. This factor should be modified annually to equal the ratio of the CPI during the post-training data collection period to the CPI during the training period.

D108 - Space reserved for future expansion.

D109 - Space reserved for future expansion.

D110-D112 - Regression coefficients used to compute amount of tax paid by an individual based on the individual's gross income levels. Procedures used to compute the coefficients for the pilot study are described in Chapter 4. The coefficients need not be changed unless federal or state tax rates change or an updated study of state-local tax incidence by income level is completed.

D113-D115 - Regression coefficients used to compute worklife expectancy based on age during the post-training data collection period. Procedures used to compute the coefficients for the pilot study are described in Chapter 4. The coefficients need not be changed unless updated information becomes available on the relationship between age and worklife expectancy.

D116 - Long-run annual inflation factor used to estimate general increase in salary for future years in computing expected lifetime earnings. Pilot study employed a rate of .055 (5.5 percent) based on the Bobbitt Study (p. 44). Alternative rates may be employed at the discretion of the user, and should be updated to reflect changes in anticipated long-run inflation rates.

D117 - Discount rate used to compute present value of expected lifetime earnings. Pilot study used a rate of .056 (5.6 percent) based on the Bobbitt Study (p. 48). This rate reflected the interest rate paid on state and local bonds at the time of the training. Alternative rates may be used at the discretion of the user, and should be updated to reflect changes in prevailing interest rates.

D118-D120 - Regression coefficients used to compute the expected annual increase in income for an individual due to increased productivity, based on the individual's age and occupation type. D118 to D120 are used in computing expected lifetime earnings without training for the completers of all programs and in computing expected lifetime earnings with training for the completers of programs with a productivity code of 1 as specified by the user (see P104 in Program-by-Institution Data File). Procedures used to compute the regression coefficients for the pilot study are described in Chapter 4. The coefficients need not be changed unless updated information is available on the relationship between age of workers and productivity growth.

D121-D123 - Similar to D118 to D120; regression coefficients used to compute the expected annual increase in income for an individual due to increased productivity. Used in place of D118 to D120 for computing expected lifetime earnings with training for programs with a productivity code of 2 as specified by the user. (Not used in pilot study.)

D124-D126 - Similar to D121 to D123; used for programs with a productivity code of 3 as specified by the user. (Not used in pilot study.)

D127-D129 - Similar to D121 to D123, used for programs with a productivity code of 4 as specified by the user. (Not used in pilot study.)

D130-D132 - Similar to D121 to D123; used for programs with a productivity code of 5 as specified by the user. (Not used in pilot study.)

D133 - Economic multiplier factor used for computing indirect public benefits. Based on the Bobbitt Study (p. 121), a factor of 5 was used for the pilot study. This factor may be modified at the discretion of the user.

C. Program - Standard Industrial Classification (SIC) Code Match File.

1. Through this file, the user may specify a listing of standard industrial classifications associated with each vocational program being studied. The vocational education cost-benefit system uses this listing in conjunction with responses to the FVEIS followup survey to determine whether an individual is employed after training in a job for which he or she has been trained.

2. The Program - SIC Code Match File developed for the pilot study relates only to the Licensed Practical Nursing (LPN), Cosmetology and Air Conditioning/Heating Mechanics programs. When a study is made involving other programs, the Standard Industrial Classification Manual of the U.S. Office of Management and Budget must be reviewed to determine what SIC codes may be associated with each vocational program included in the study. A listing of SIC code - program code matches is then prepared for inclusion in the computer program.

D. Program-By-Institution Data File

1. The program-by-institution data file provides a means for the user to enter the cost and pupil data obtained for each program/institution in steps 4 and 5 of this outline. Each item must be provided for each program/institution in the study.

2. The items included in the program-by-institution data file are listed below. Specific values used in the pilot study are discussed in Chapter 4 of this report.

   P100 - Program direct public cost per student, including operating expense and depreciation of equipment.

   P101 - Program direct private cost per student, including cost to the student for (a) registration, tuition, shop and material fees, (b) cost of books, (c) cost of supplies, and (d) cost of uniforms and other special clothing required.

   P102 - Program length in years.

   P103 - Program average student age.

   P104 - Program productivity code.

   P105 - Program age computation flag, where 1 indicates that program average student age is to be input from the program-by institution data file using P103, and 0 indicates that the program average student age is to be computed from the individual student data.

E. User determines appropriate data for each of the three user input files and provides these data to computer processing staff for input.

VIII. Run Computation Program, Calculating Benefit/Cost Ratios and Rates of Return.

A. This step is completed by computer processing staff at the request of the user. Information necessary for running or modifying the programs is included in the Technical Manual (Appendix D).

IX. Prepare Finding and Conclusions Based on System Outputs.

Chapter 3

System Output Reports

The Vocational Education Cost-Benefit System generates three sets of output reports. The first two sets of reports provide detailed listings of the data included on the student master file and the program master file, while the third set of reports summarizes the major steps in the benefit-cost ratio and rate of return calculations.

The first output report is a listing of the data making up the student master file. Definitions for the items included on the student master file and the actual student master file listing for the pilot study are included in Appendix F. The listing shows the actual data used for each of the 271 students included in the pilot study. The printout is sorted in program-by-institution sequence with page breaks between the various program/institutions. Within program/institutions, the student data are sorted in ascending Social Security Number order.

The program master file listing is the second system output report. The program master file consists of the averages for the students within each program/institution for the items on the student master file, plus a number of additional variables computed from these averages. Definitions of the items making up the program master file and the actual program master file listing for the pilot study are included in Appendix G. One observation appears on the program master file for each program/institution in the pilot study, and these observations are sorted in program/institution order. At the beginning of the listing, additional observations are included

for summary data which have been aggregated (1) by program across all institutions and (2) by program across all institutions with a given institution type (community college or area vocational center).

The first two reports enable the user to review the detailed information used in computing the benefit-cost ratios and rates of return. Complete data are provided for each individual in the study sample, and the results of all of the computations leading up to the cost-benefit ratios and rates of returns are given.

The third set of reports summarizes the major steps in the calculation of cost-benefit ratios and rates of return for each program/institution in the study. Summary reports are printed for three levels of aggregation:

1. Program/Institution, e.g., Licensed Practical Nursing at Miami-Dade Community College.
2. Program/Institution Type, e.g., Licensed Practical Nursing for all community colleges or all area vocational centers in the study sample.
3. Program, e.g., Licensed Practical Nursing for all institutions in the study sample.

A two-page report is printed for each program/institution, program/institution type, and program included in the study sample. The first page of the report reviews the benefit-cost ratio and rate of return computations for the program/institution, program/institution type, or program based on the full employment wage model, while the second page reports these computations based on the variable employment wage model. A sample page from a summary report is shown in Figure 1.

Definitions of the age models, subgroups of program completers, and data items appearing on the summary reports are given in the outline below. The user input decisions referred to in the outline are described in Chapter 2, part 7.

Figure 1

FLORIDA DEPARTMENT OF EDUCATION
VOCATIONAL EDUCATION COST-BENEFIT SYSTEM
COMPUTATION OF COST-BENEFIT RATIOS AND RATES OF RETURN

PROGRAM: 3043--LICENSED PRACTICAL NURSING INSTITUTION TYPE: COMM COLL INSTITUTION: 15060--MIAMI DADE

WAGE MODEL: FULL EMPLOYMENT

DESCRIPTION (PROGRAM AVERAGES)	SUBGROUP OF PROGRAM COMPLETERS			
	ALL COMPLETERS	COMPLETERS WITH VALID WAGE DATA	COMPLETERS IN JOB FOR WHICH TRAINED	COMPLETERS WITH VALID WAGE DATA AND IN JOB FOR WHICH TRAINED
NUMBER OF INDIVIDUALS	55	10	37	8
PRETRAINING SALARY	$6,181.97	$7,423.23	$6,273.97	$7,651.58
TRAINING PERIOD SALARY	$2,059.66	$2,889.93	$1,796.66	$2,605.29
POST-TRAINING SALARY	$7,416.81	$8,772.22	$8,026.01	$8,757.42
DIRECT PRIVATE COST	$972.00	$972.00	$972.00	$972.00
DIRECT PUBLIC COST	$4,000.00	$4,000.00	$972.00	$4,000.00
AGE	21	21	21	13
EXPECTED WORK YEARS	40	40	40	40
PRESENT VALUE OF LIFETIME SALARY				
WITHOUT TRAINING	$204,513.55	$241,870.45	$238,747.81	$252,149.65
WITH TRAINING	$303,847.22	$359,374.60	$320,804.49	$358,784.81
PRESENT VALUE OF LIFETIME TAXES				
WITHOUT TRAINING	$54,294.27	$66,811.94	$55,197.21	$69,120.55
WITH TRAINING	$58,444.53	$70,795.16	$63,905.92	$70,621.35
GROSS PRIVATE BENEFIT	$19,333.67	$17,504.16	$40,055.67	$6,435.16
NET PRIVATE BENEFIT	$15,183.41	$13,563.84	$31,347.98	$5,134.36
DIRECT PUBLIC BENEFIT	$4,150.26	$3,943.32	$8,709.71	$1,500.81
INDIRECT PUBLIC BENEFIT	$96,668.34	$87,520.78	$200,293.37	$33,175.81
TOTAL PUBLIC BENEFIT	$100,818.60	$91,464.09	$208,992.07	$34,676.62
PRIVATE COST	$4,611.39	$4,958.45	$4,909.76	$5,386.53
PUBLIC COST	$4,868.01	$5,004.57	$4,934.38	$5,108.39
PRIVATE BENEFIT-COST RATIO	3.293	2.729	6.393	0.953
DIRECT PUBLIC BENEFIT-COST RATIO	0.853	0.788	1.765	0.294
TOTAL PUBLIC BENEFIT-COST RATIO	20.710	18.276	42.354	6.788
PRIVATE RATE OF RETURN	14.600	12.700	24.300	5.330
DIRECT PUBLIC RATE OF RETURN	5.800	5.500	10.700	1.000
TOTAL PUBLIC RATE OF RETURN	62.700	56.100	119.700	24.600

Vocational Education Cost-Benefit System

Definitions of Terms used in Summary Report

A. Wage Models

1. Full Employment Wage Model - Wage model based on the assumption that each individual in the sample is employed full-time for the entire year both before and after training. Given equal levels of employment before and after training, differences between pretraining salary and post-training salary are due entirely to changes in wage rates associated with the training. Pretraining and post-training salary levels are determined by computing the respective weekly wages for each individual for the weeks actually worked, then multiplying the weekly wages by 52 to determine the annual salary. In the absence of valid wage data for an individual, an assumed wage rate may be inserted by the user (see decision D103).

2. Variable Employment Wage Model - Wage model based on the assumption that each individual in the sample is employed to the same degree that the individual was actually employed during the two-quarter pretraining and post-training data collection periods. Under this model, differences between pretraining salary and post-training salary may be caused by changes in level of employment as well as changes in wage rates. Pretraining and post-training salary levels are determined by multiplying the individual's actual earnings during the respective two-quarter periods by two to determine the annual salary.

B. Subgroups of Program Completers

1. All Completers - All individuals within the specific program/institution for which data records including Social Security Number have been collected from the FVEIS followup file or the Community College followup file.

2. Completers with Valid Wage Data - The subgroup of All Completers composed of individuals with wage records from the Florida Department of Labor and Employment Security having the following characteristics:

   (a) Worked at least a minimum number of weeks as specified by the user (see decision D100) during both of the two-quarter data collection periods before and after training, and

   (b) Had weekly wages during both of the two-quarter data collection periods which fall within a reasonable

range as specified by the user (see decisions D101 and D102).

3. Completers in Job for which Trained - The subgroup of program completers composed of individuals with the following characteristics:

   (a) Response to FVEIS Followup Survey (see Appendix C), Question 4, was a 1 or 2, indicating that the individual was in a job for which trained or a job which uses some of the skills learned in training, or

   (b) Standard Industrial Classification (SIC) Code from the individual's wage record for the second quarter of the post-training data collection period is included on a Program - SIC code Match File supplied by the user; indicating that the individual is employed in an industry in which persons with the skills learned in the program are generally employed.

4. Completers with Valid Wage Data and in Job for which Trained - The subgroup of program completers composed of individuals with both valid wage data as specified in 2 and in job for which trained as specified in 3.

C. Program Averages - Averages for the individuals within a specific subgroup of program completers are computed using each wage model for the following variables:

1. Pretraining Salary

   (a) Full Employment Model

      (1) For Completers with Valid Wage Data - Total Wages during the two-quarter pretraining data collection period, divided by total weeks worked during this period to determine weekly wage, multiplied by 52 to determine annaul salary.

      (2) For Other Completers - Assumed weekly wage rate specified by user (see D103) times 52.

   (b) Variable Employment Model - Total wages during two-quarter pretraining data collection period times two to determine annual salary.

   After computing the pretraining salary under the two alternative wage models, the computed amounts are increased by an inflation factor specified by the user (see D104 and D105) such that the pretraining and posttraining salaries are expressed in dollars of equivalent purchasing power.

2. Training Period Salary - Total wages during two-quarter training period data collection interval times two, times an inflation

factor specified by the user (see D107) such that the training period and post-training salaries are expressed in dollars of equivalent purchasing power. The inflation factor applied to the training period salary (D107) is designed to reflect one year of inflation between the training period and the post-training period; the inflation factor applied to the pretraining salary reflects two years of inflation between the pretraining period and the post-training period for a one year program (D104) or an alternate period of inflation for programs of more than one year (D105).

3. Post-Training Salary - Annual salary computed based on wage data from post-training data collection period; computation procedures are identical to pretraining salary except that no inflation factors are applied.

4. Age - Based on user input (see P105), average age for subgroups of program completers may be computed from individual student data, or may be specified by user (see P103) in the absence of individual student age data.

5. Expected Work Years - This is the number of years that the specified group of completers is expected to work after completing training. It is computed from the age factor based on the work life expectancy-age relationship reported in a 1976 Monthly Labor Review study by Fullerton and Byrne. The coefficients necessary for polynomial regression of worklife expectancy based on age (see D113, D114, D115) were computed from data reported in that study and are input by the user. The formula for computing expected work years based on age is as follows:

$$\text{Expected Work Years} = (\text{Age} * D113) + [(\text{Age})^2 * D114] + D115$$

6. Present Value of Lifetime Salary - The present value of lifetime salary is computed using the following equation:

$$\text{Present Value} = \sum_{n=1}^{x} \left[\{(\text{Base Salary}) * (z+p)^n \} * \left(\frac{1}{(1+r)^n} \right) \right]$$

Where:

n = year, beginning with n=1 for the first year after training and going up to x, the number of expected work years.

Base Salary = the annual salary for a specific subgroup of program completers for the first year after completing training:

a. For computing the present value of lifetime salary with training, the base salary is equal to the "post-training salary" printed in the report.

b. For computing the present value of lifetime salary without training, the base salary is equal to the "pretraining salary" printed in the report adjusted for salary increase due to productivity growth between the pretraining period and the posttraining period.

z = The long-run inflation factor specified by the user in decision D116.

p = The age-specific productivity factor computed from decisions D118 to D120. The rate of increase in salary due to increased productivity is assumed to vary with age as specified in the following equation:

$$p = [(Age+n-1) * D118] + [(Age+n-1)^2 * D119] + D120$$

r = The discount rate specified by the user in decision D117.

7. Present Value of Lifetime Taxes - These amounts are computed by determining tha tax rate paid by the individual on his or her base salary, then applying that tax rate to the present value of the individual's lifetime salary. The base salaries used for computing the tax rates applied to the individual's lifetime salary with and without training, respectively, are the same as those used in the present value of lifetime salary computations in item 9 above. These calculations are based on the assumption that the tax rate paid by the individual will remain a fixed percent of the individual's income throughout his or her working life. The calculation of the tax rate on the individual's base salary is made by applying the regression coefficients D110, D111, and D112 to the base salary as follows:

$$\text{Tax rate} = (\text{base salary} * D110) + [(\text{base salary})^2 * D111] + D112$$

8. Gross Private Benefit - The gross private benefit equals the present value of lifetime salary with training minus the present value of lifetime salary without training.

9. Net Private Benefit - The net private benefit equals the present value of net lifetime salary after taxes with training minus the present value of net lifetime salary after taxes without training. It is computed as follows:

Net Private Benefit =

(Present value of lifetime salary with training -
Present value of lifetime taxes with training) —
(Present value of lifetime salary without training -
Present value of lifetime taxes without training).

10. Direct Public Benefit - The direct public benefit is equal to the present value of lifetime taxes with training minus the present value of lifetime taxes without training.

11. Indirect Public Benefit - The indirect public benefit is equal to the gross private benefit multiplied by the economic multiplier factor specified by the user in decision D133.

12. Total Public Benefit - The total public benefit is equal to the direct public benefit plus the indirect public benefit.

13. Private Cost - The private cost is equal to the direct private cost plus net foregone earnings. Net foregone earnings are equal to the difference between what the individual's net salary after tax would have been during the training period (based on the pretraining salary adjusted for productivity growth less tax) and the individual's actual net salary after taxes during the training period. Net foregone earnings may not be less than zero.

14. Public Cost - The public cost is equal to the direct public cost plus the amount of tax foregone during the training period.

15. Private Benefit-Cost Ratio - The private benefit-cost ratio is equal to the net private benefit divided by the private cost.

16. Direct Public Benefit-Cost Ratio - The direct public benefit-cost ratio is equal to the direct public benefit divided by the public cost.

17. Total Public Benefit-Cost Ratio - The total public benefit-cost ratio is equal to the total public benefit divided by the public cost.

18. Private Rate of Return - The private rate of return is computed by solving the following equation for i, the rate of return:

$$\sum_{n=1}^{x} \left[(\text{Net Salary with Training}_n - \text{Net Salary without Training}_n) * \frac{1}{(1+i)^n}\right]$$

$$-\text{Private Cost} = 0$$

Where:

n = year, beginning with n=1 for the first year after training and going up to x, the number of expected work years

$$\text{Net Salary with Training}_n = [\text{Post-training Salary} * (z+p)^n] * (1 - \text{Tax Rate}_1)$$

Where: z = long run inflation factor specified in decision D116

p = age-specific productivity factor computed as in present value of lifetime salary calculations.

n = year

Tax $rate_1$ = Tax rate on post-training salary computed in present value of lifetime taxes calculations.

$$\text{Net Salary Without Training}_n = [\text{Adjusted Pretraining Salary} * (z+p)^n] * (1 - \text{Tax Rate}_2)$$

Where: Adjusted pretraining salary = pretraining salary adjusted for productivity growth as in computing base salary for present value of lifetime salary without training calculation.

z = long run inflation factor specified in decision D116

p = age-specific productivity factor

Tax $Rate_2$ = Tax rate on adjusted pretraining salary (base salary for present value of lifetime salary without training computation) computed in present value of lifetime taxes calculations.

19. Direct Public Rate of Return - The direct public rate of return is computed by solving the following equation for i, the rate of return:

$$\sum_{n=1}^{X} [(\text{Tax with Training}_n - \text{Tax Without Training}_n) * \frac{1}{(1+i)^n}] - \text{Public Cost} = 0$$

Where:

n = year, beginning with n=1 for the first year after training and going up to X, the number of expected work years.

$$\text{Tax with Training}_n = [\text{Post-Training Salary} * (z+p)^n] * (\text{Tax Rate}_1)$$

$$\text{Tax without Training}_n = [\text{Adjusted Pretraining Salary} * (z+p)^n] * (\text{Tax Rate}_2)$$

The factors in the above equations have the same definitions as the factors in the equations for computing the Net Salary with and without training in item #18 above

20. Total Public Rate of Return - The total public rate of return is computed by solving the following equation for i, the rate of return:

$$\sum_{n=1}^{x} [(\text{Gross Salary with Training}_n * D133) - (\text{Gross Salary without Training}_n * D133)]$$

- Public Cost = 0

Where:

n = year, beginning with n=1 for the first year after training and going up to x, the number of expected work years

$\text{Gross Salary with Training}_n = [\text{Post-Training Salary} * (z+p)^n]$

$\text{Gross Salary without Training}_n =$

$[\text{Adjusted Pretraining Salary} * (z+p)^n]$

The factors in the above equations have the same definitions as the factors in the equations for computing the net salary with and without training in item #18 above.

D133 = Economic multiplier factor specified by the user in decision D133.

Chapter 4

Pilot Test of System

This project included two phases, development of the system and its pilot testing. The results of the pilot test are given in this chapter.

Certain initial decisions must be made, and for testing purposes three programs, licensed practical nursing, cosmetology, and air conditioning/heating mechanics, and technology were used. Individual student data were obtained from the Florida Vocational Education Information System (FVEIS) followup file and the Community College Placement and Followup System. As explained in Chapter 2, these data were passed against the wage files of the Department of Labor and Employment Security to determine earnings before, during and after training. Direct private cost data were collected from the selected institutions, and direct public cost data were obtained from program cost reports of the Department of Education.

Benefits

The private benefits measured in this study consist of the difference between the students' earnings prior to the vocational training and the actual earnings during the first year after completing the vocational programs, plus a projection of lifetime earnings. The lifetime earnings projections included adjustments for : (a) a productivity factor associated with each occupation or classification; (b) an inflation factor; (c) work life expectancy; and (d) an interest rate to compute the present value of the work life projections.

Direct public benefits were measured in this study by the marginal difference between federal, state, and local taxes estimated on the work life

earnings of the vocational graduates and the taxes estimated over a work life based on the average prior earnings of the graduates.

Projections of Federal income tax payments over the work life of the graduates were made on the basis of the rate applicable on the 1977 earnings for a married couple with two children, filing a joint return. After computing the appropriate tax on the 1977 earnings, the percentage of gross income that tax represents was determined. This percentage rate was then applied to each year's gross income to determine the estimate of the Federal tax due.

Estimates of State tax payments were based on a study performed by Lile,[1] in which it was estimated that families of four in Florida with an adjusted gross income of $7,500 pay a state and local tax burden of approximately 6.4% of their income; families with income of $10,000 pay approximately 5.4%; families with income of $15,000 pay approximately 4.4%; and families with income of $25,000 pay approximately 3.4% of their income in state-local taxes.

Indirect public benefits measured in this study were based on the multiplier effect. A multiplier of five times the net increase in gross earnings was used to approximate the total effect the graduates' increased earnings had on the entire economy.

Costs

In calculating the direct private costs of the vocational training, actual 1976-7 costs were used as reported by the selected community colleges and area vocational centers for: (a) registration, tuition, shop, and materials fees; (b) cost of books; (c) cost of supplies; and (d) cost of uniforms or other

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[1]Stephen E. Lile, Family Tax Burdens Compared Among States and Among Cities Located in Kentucky and Neighboring States, Kentucky Department of Education, Frankfort, Kentucky, 1978, p. 46.

special clothing required. Indirect private costs were determined by calculating the net income foregone by the students while participating in the vocational training.

Cost data reported on the Annual District Financial Report (PL 4) were computerized and utilized by the Division of Vocational Education to determine the cost per completing student for each of the surveyed programs. Five steps were utilized to determine the cost per student:

1. Determination of total operating budget costs per course.
2. Determination of total equipment depreciation costs per course.
3. Determination of student enrollment per course.
4. Computation of course cost per student.
5. Computation of program cost per student based on summation of course costs for the courses included in a model program for each program area as determined by the Division of Vocational Education.

What the System Produces

As stated above in more detail, the system provides for benefit-cost analysis at three levels of aggregation: (a) program/institution type/institution, (b) program/institution type, and (c) program. In other words, the system provides a printout indicating the benefit-cost ratio and rate of return by program (for example, licensed practical nursing) for either the area vocational technical center or the community college which has the program. This is aggregated at the state level, either altogether or separately, by voc-tech center or community college. At the highest level, all programs and all institutions, throughout the state, can be combined to produce one benefit-cost ratio or a single rate of return.

Summary of Computations

Program Average Computations

1. All computations are made at three levels of aggregation: (a) Program/Institution Type/Institution, (b) Program/Institution Type, and (c) Program.

2. Separate computations are made for the following subgroups of students: (a) all students within the level of aggregations, (b) students with valid wage data, (c) students in job for which trained, and (d) students in job for which trained and valid wage data.

3. For each of these subgroups, program averages are computed based on the following salary models: (a) full employment model and (b) variable employment model. This creates 4 x 2 or 8 sets of computations for each level of aggregation.

4. Program averages are computed for the following data: (a) age, (b) pre-training salary, (c) training period salary, and (d) post-training salary.

Benefit/Cost Ratio Computations

1. Foregone earnings.
2. Expected work years.
3. Present value of projected lifetime earnings based on post-training salary and based on adjusted pre-training salary.
4. Present value of projected lifetime taxes under alternative salary projections.
5. Direct public benefit (based on incremental taxes).
6. Net private benefit (based on incremental net salaries).
7. Indirect public benefit (based on economic multiplier).
8. Total public benefit (direct and indirect).
9. Public cost.
10. Private cost.

11. Benefit/cost ratios:

Public	=	Total public benefit/public cost
Private	=	Net private benefit/private cost
Direct Public	=	Direct public benefit/public cost

12 Rates of return.

Computation of Tax, Worklife Expectancy and Productivity Coefficients

Any rate of return analysis of this type requires the researcher to estimate the impact of taxes on earnings, worklife of individuals, and increased productivity of workers. This can be done in various ways. It is necessary to retrogress at this point to explain the methods used in this model in order that the reader can better interpret the results of the pilot test.

Regression Coefficients for Computing Tax (D110 to D112)

The regression coefficients specified in decisions D110 to D112 enable the user to determine the amount of federal, state, and local taxes paid by a representative individual in a specific subgroup of program completers based on the average annual salary for that subgroup. Data used in the pilot study for determining amount of taxes paid based on income were obtained from various sources. First, effective state-local rates by income level for model families of four in Florida were obtained from a study completed by Lile.[2]

Annual Income	Florida State-Local Taxes
$ 7,500	$ 480
10,000	540
15,000	660
17,500	700
25,000	850
50,000	1,250

[2] Ibid.

Three major federal taxes were included in the tax incidence estimates. Federal personal income tax estimates were computed based on 1978 federal personal income tax rates for married persons with four exemptions filing a joint return and using the standard deduction. Social security tax was computed at the 1978 rate of 6.05 percent on the first $17,700 of gross income. Federal corporate income tax incidence estimates were obtained from a study by Pechman.[3] The overall federal tax rate assumed for the pilot study was computed as follows:

Annual Income	Personal Income Tax	Social Security Tax	Corporate Income Tax	Total Federal Tax
$ 2,000	$ 0	$ 121	$ 92	$ 213
4,000	0	242	140	382
6,000	0	363	186	549
8,000	116	484	248	848
10,000	442	605	310	1,357
12,000	817	726	324	1,867
14,000	1,182	847	378	2,407
16,000	1,591	968	416	2,975
18,000	2,031	1,071	468	3,570
20,000	2,542	1,071	520	4,133
25,000	3,857	1,071	625	5,553
30,000	5,408	1,071	780	7,259

Given the effective rate of federal and state-local taxes for selected income levels from the above tables, curvilinear regression runs were made to develop regression equations which could be used to determine estimated federal and state-local effective tax rates for all possible income levels. The REGRESSION subprogram of the Statistical Package for the Social Sciences was used to develop separate equations for predicting federal and state-local tax amounts based on income. Income and the square of income were used as the independent variables for the analyses to predict the amount of tax paid.

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[3]Joseph A. Pechman, Federal Tax Policy, The Brookings Institution, 1977, p. 136.

Using the total federal tax column of the above table, the regression equation developed for predicting the amount of federal tax paid based on income is given below:

$$\text{Federal Tax} = (.134178 * \text{Income}) + (.00000397586 * \text{Income}^2) - 268.21$$

Using the Lile[4] data, the regression equation developed for predicting state-local tax paid based on income is as follows:

$$\text{State-Local Tax} = (.025167 * \text{Income}) + (.00000012395 * \text{Income}^2) + 301.10$$

The two equations developed for predicting, respectively, federal and state-local taxes based on income were then combined to form one equation for predicting total taxes paid based on income. This was accomplished by simply summing the two equations as follows:

	Federal Tax	$(.134178 * \text{Income}) + (.00000397586 * \text{Income}^2) - 268.21$
+	State-Local Tax	$(.025167 * \text{Income}) + (.00000012395 * \text{Income}^2) + 301.10$
=	Total Tax	$(.159345 * \text{Income}) + (.00000385191 * \text{Income}^2) + 32.89$

To determine the total tax amount for a given income level, the income level is inserted in the regression equation. For example, the tax per completer paid in the first year after training by a subgroup of program completers with an average income of $8,000 would be computed as follows:

$$\begin{aligned}\text{Total Tax} &= (.159345 * 8{,}000) + (.00000385191 * 8{,}000^2) + 32.89 \\ &= 1274.76 + 243.20 + 32.89 \\ &= 1{,}550.85\end{aligned}$$

The Vocational Education Cost-Benefit System includes the following regression equation for determining the amount of tax paid based on income:

$$\text{Tax} = (D110 * \text{Income}) + (D111 * \text{Income}^2) + D112$$

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[4] Lile, Family Tax Burdens Compared Among States and Among Cities Located In Kentucky and Neighboring States.

Using the regression coefficient determined through the above analysis, the following decisions were specified for the pilot study:

D110 = .159345

D111 = .00000385191

D112 = 32.89

The user may specify alternative tax incidence levels by re-running the regression equations for predicting federal and/or state-local taxes using revised data then inserting the resulting coefficients in decisions D110, D111, and D112.

Worklife Expectancy Regression Coefficient (D113 to D115)

The number of expected work years for each subgroup of program completers within each program/institution in the pilot study was determined from data reported in a 1976 Monthly Labor Review study by Fullerton and Byrne.[5] That study included worklife expectancy tables based on age for men and women using 1970 data. In the pilot study, the average worklife expectancy reported by Fullerton and Byrne for men and single women was employed as shown below:

Age	Number of Expected Work Years
20	41.35
25	36.65
30	32.45
35	28.05
40	23.60
45	19.15
50	14.90
55	10.90

Rather than including a table of worklife expectancies in the system giving the number of expected work years for each possible average age of

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[5]H. N. Fullerton and J. J. Byrne, "Length of Working Life for Men and Women, 1970," Monthly Labor Review, Vol. 99(21), February 1976, pp. 31-33.

program completers, a curvilinear regression model was developed for this purpose. The REGRESSION component of the Statistical Package for the Social Sciences (SPSS) was used to develop the regression model. Age and the square of age were used as independent variables to predict number of expected work years. Using the Fullerton and Byrne data, the following regression equation was developed for predicting expected work years from age and the square of age:

$$\text{Expected Work Years} = (-.9479176 * \text{Age}) + (.001011919 * \text{Age}^2) + 59.87233$$

To determine the expected work years for a specific subgroup of program completers, the actual average age for that subgroup is inserted into the regression equation. For example, the number of expected work years for a group of program completers with an average age of 22 would be calculated as follows:

$$\begin{aligned}\text{Expected Work Years} &= (-.9479176 * 22) + (.001011919 * 22^2) + 59.87223 \\ &= -20.85418 + .48976 + 59.87223 \\ &= 39.50781\end{aligned}$$

A regression equation of the form

$$\text{Expected Work Years} = (D113 * \text{Age}) + (D114 * \text{Age}^2) + D115$$

is used in the Vocational Education Cost-Benefit System for the calculation of expected work years based on age. Using the regression coefficients determined from the Fullerton and Byrne data, the following decisions were specified for the pilot study:

$$D113 = -.9479176$$

$$D114 = .001011919$$

$$D115 = 59.87223$$

The user may insert alternative worklife expectancy data into the model by re-running the regression of worklife expectancy based on age and age squared using the alternative worklife expectancy data, then employing the resulting regression coefficients in decisions D113, D114, and D115.

Productivity Regression Coefficients

Several decisions (D118 to D132) are included in the Vocational Cost-Benefit System to enable the user to specify different age-productivity relationships for groups of individuals with different levels and fields of training. Regression equations for determining annual rate of increase in salary due to productivity growth based on age are used in the system's lifetime salary projections.

Regression coefficients D118, D119, and D120 are used to determine age-productivity relationships in computing projected lifetime salaries without training for all programs and with training for programs assigned a productivity code of 1 by the user (See P104 in program-by-institution data file, Chapter 2). Where data are available concerning age-productivity relationships for specific occupations, alternative regression coefficients may be used by assigning an alternative productivity code to specific vocational programs leading to these occupations. D121, D122, and D123, for example, are used for programs assigned a productivity code of 2.

A regression equation must be developed for each productivity code used in a specific study. For the pilot study, no attempt was made to distinguish between age-productivity relationships of various occupations and all programs were assigned a productivity code of 1. National data for 1975 reported by the U.S. Department of Commerce in 1977 were used to determine annual productivity growth rates by age for high school graduates employed full-time yearround. These rates were determined as shown on the following page.

Age Group	Mean Annual Earnings	Average Age in Age Group	Average Annual Earnings Increase	Productivity Factor
18-22	$ 7,206	21	$ 451.33	1.0626
25-29	9,914	27	279.80	1.1282
30-34	11,313	32	113.60	1.0100
35-39	11,881	37	29.60	1.0024
40-44	12,029	42	68.20	1.0056
45-49	12,370	47	3.40	1.0002
50-54	12,387	52	13.98	0.9888
55-59	11,688	57	.80	1.0000
60-64	11,692	62	–	–

Based on the mean annual earnings by age group reported by the U.S. Department of Commerce, productivity factors by age were developed as follows:

1. The average age within each age group was determined.

2. The increase in mean annual earnings between age groups was converted to an average annual earnings increase by dividing the total earnings increase by the number of years between the average ages of the respective age groups.

3. The productivity factor for each age was determined by adding one to the quotient of the Average Annual Earnings Increase and the Mean Annual Earnings.

Given the productivity factors for specific ages as shown above, curvilinear regression analysis was conducted to develop a regression equation for predicting productivity factors for all ages. Using age and the square of age as independent variables, the regression equation was generated using the SPSS REGRESSION procedure:

Productivity factor #1 = (-.008270514 * Age) + (.00008566332 * Age^2) + 1.193437

To determine the productivity factor for computing the projected increase in salary for each year of an individual's worklife, the age of the individual in that year is inserted into the formula.

A regression equation of the form

Productivity factor #1 = (D118 * Age) + (D119 * Age^2) + D120

is used in the Vocational Education Cost-Benefit System for calculating

the productivity increase for each year of an individual's expected worklife. Using the regression coefficients determined above, the following decisions were specified for the pilot study:

D118 = -.008270514

D119 = .00008566332

D120 = 1.193437

As with other decisions based on regression runs, D118, D119, and D120 may be revised based on alternative regression runs using updated data. Additional regression runs may be completed to determine values for D121 to D132 based on data relating to age-productivity relationships within specific occupations.

Other System Decisions

The system developed here provides results different from most benefit-cost systems or studies developed and conducted before primarily because here the data reflect actual wages earned by the program participants both before and after the period of training. This approach is, for example, substantially different from the system created by Ghazalah[6] for the Department of Education of Ohio in which he used the federal minimum wage weighted by per capita income relative to the geographical location surrogate measure for actual wages. The present system uses actual wages in the variable employment model and actual wages plus a minimum given salary for the full employment model. Using the methodology we devise here it becomes unnecessary to compare vocational programs with either high school completers or with alternative forms of

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[6] I. A. Ghazalah, A Computerized, Regional Cost-Benefit Formula System, Division of Vocational Education, Department of Education, State of Ohio, Columbus, February, 1978.

employment since here we use actual data from each trainee's previous employment.

The present system is adaptable in regard to the number of employment quarters used prior to training to determine pretraining wages for the variable model, but for purposes of the pilot test a minimum of four weeks work within the two quarter period was arbitrarily set as the wage period for the pilot test to determine valid wage data (D100). When this figure was changed to eight weeks certain and sometimes rather appreciable differences were noted in the outcome.

Where wage data were lacking, the minimum weekly wage was inserted into both the before and after training period average earnings computation at a rate of $2.50 per hour for a 40 hour week or $100 (D101). Additionally, for the pilot test, a maximum weekly wage of $1000 was set for the average quarterly earnings computation (D102).

Since inflation is ever present, it was necessary to adjust the pretraining wage rates to make them comparable to post-training earnings. This was accomplished by dividing the December 1976 Consumer Price Index (CPI) by the December 1975 Consumer Price Index. Similarly, during-training earnings were brought up to post-training equivalent value by dividing the December 1977 CPI by the December 1976 CPI. The system will, of course, accommodate continued annual changes.

Other factors used in the pilot test were a long-run annual inflation factor of 5.5 percent used to determine present value of future salary computations (D116).[7] The discount rate used for finding the present value of future salary computations was 5.6 percent (D117).[8] An economic multiplier

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[7]Bobbitt, op. cit.

[8]Ibid.

of five, as recommended by Bobbitt and others, was used to estimate the total public benefit (D133).[9]

Results of Pilot Test

Summary tables are presented below showing both the benefit-cost ratio and the rate of return for the various classifications applied to the system. Three programs, licensed practical nursing, cosmetology, and air conditioning/heating mechanics were first aggregated for all institutions, both voc-tech centers and community colleges, for both the full employment and the variable employment models.

Table I shows that licensed practical nursing is a good investment for the individual and for society using both the full employment and variable employment models. One can observe from the data, as given in Appendix H, how the average earnings of those trained increased after the period of training. The private benefit is also enhanced by the earnings obtained by the trainees during the training period. The benefit to the public is shown to be quite high when the total public benefit is taken into account. When only the direct public benefits are shown, the rate of return falls to near the rates which could be acquired by investment in alternative forms of investments in the private sector.

The data in Table II show that the air conditioning and heating mechanics program also has a relatively high benefit-cost ratio and a substantial rate of return for the individual. Both the benefit-cost ratio and the rate of return for completers with valid wage data are lower than for licensed practical nursing. Probably the best indicator of the value of the program, completers with valid wage data in jobs for which trained in the variable model, shows

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[9] Ibid.

Table I

Licensed Practical Nursing --
All Selected Voc-Tech Centers and Community Colleges

		Completers with Valid Wage Data	Completers with Valid Wage Data in Job for Which Trained
Full Employment Model	Private B/C Ratio	9.701	6.765
	Direct Public B/C Ratio	1.841	1.305
	Total Public B/C Ratio	44.964	32.092
	Private Rate of Return	37.400	28.300
	Direct Public Rate of Return	11.100	8.500
	Total Public Rate of Return	146.400	109.900
Variable Employment Model	Private B/C Ratio	32.965	29.886
	Direct Public B/C Ratio	2.444	2.279
	Total Public B/C Ratio	65.649	61.495
	Private Rate of Return	113.500	106.900
	Direct Public Rate of Return	12.800	12.400
	Total Public Rate of Return	211.400	205.300

Table II

Air Conditioning and Heating Mechanics --
All Selected Voc-Tech Centers and Community Colleges

		Completers with Valid Wage Data	Completers with Valid Wage Data in Job for Which Trained
Full Employment Model	Private B/C Ratio	7.549	3.334
	Direct Public B/C Ratio	1.746	1.083
	Total Public B/C Ratio	36.504	24.528
	Private Rate of Return	31.300	16.000
	Direct Public Rate of Return	11.500	8.300
	Total Public Rate of Return	125.100	85.000
Variable Employment Model	Private B/C Ratio	9.604	22.944
	Direct Public B/C Ratio	1.382	4.818
	Total Public B/C Ratio	30.074	113.716
	Private Rate of Return	38.500	83.300
	Direct Public Rate of Return	8.800	25.100
	Total Public Rate of Return	104.300	371.100

a good benefit for the program. Unfortunately, the ability to generalize this result is severely limited by the small number of completers in this category, only 3. The importance of minimizing foregone earnings is shown quite vividly here as it was with licensed practical nursing (see Appendix H).

With cosmetology, Table III, the investment picture is radically altered. Completers with valid wage data are shown in Appendix H to actually earn less, on the average, after training than before. In this case, also, the training period salary is relatively lower than in the other two programs. From the data available, the result is that cosmetology appears to have a negative benefit-cost ratio and no beneficial rate of return. However, one would be well advised not to draw conclusions too readily since the number of completers with valid wage data and the completers with valid wage data in job for which trained number only 9 and 8, respectively.

Observations

A review of the data indicates that the computerized system does, in fact, work and provides data by programs, institutions, and type of institution. All the various levels of aggregation are in Appendix H.

In using the system, though, many questions must naturally arise. For example, what would be the impact if the pretraining earnings period were expanded to include more wage data? What would be the impact adjustments of four weeks up to, say, six or eight weeks in determining the average quarterly earnings for both before and after the training period? What would be the impact of altering certain other pilot test parameters such as changing the amounts assumed to constitute a minimum weekly wage? What effect would alternative adjustments in the discount rate have on the results?

The most important factor, though, in improving the accuracy of the data would be to increase the number of individuals in the study. The data

Table III

Cosmetology --
All Selected Voc-Tech Centers and Community Colleges

		Completers with Valid Wage Data	Completers with Valid Wage Data in Job for Which Trained
Full Employment Model	Private B/C Ratio	-9.399	-11.669
	Direct Public B/C Ratio	-3.887	-4.850
	Total Public B/C Ratio	-94.410	-117.712
	Private Rate of Return	-0-	-0-
	Direct Public Rate of Return	-0-	-0-
	Total Public Rate of Return	-0-	-0-
Variable Employment Model	Private B/C Ratio	-10.228	-15.435
	Direct Public B/C Ratio	-2.347	-3.498
	Total Public B/C Ratio	-62.405	-93.340
	Private Rate of Return	-0-	-0-
	Direct Public Rate of Return	-0-	-0-
	Total Public Rate of Return	-0-	-0-

available suggests that to increase the number of participants in the study would reduce the likelihood of unreliable fluctuations in both the benefit-cost ratios and rates of return.

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APPENDIX A

Program Code Listing: Area Vocational Centers
(Deleted - See Master Copy)

APPENDIX B

Program Code Listing: Community Colleges
(Deleted - See Master Copy)

APPENDIX C

Florida Vocational Education Information System (FVEIS) Followup Survey
(Deleted - See Master Copy)

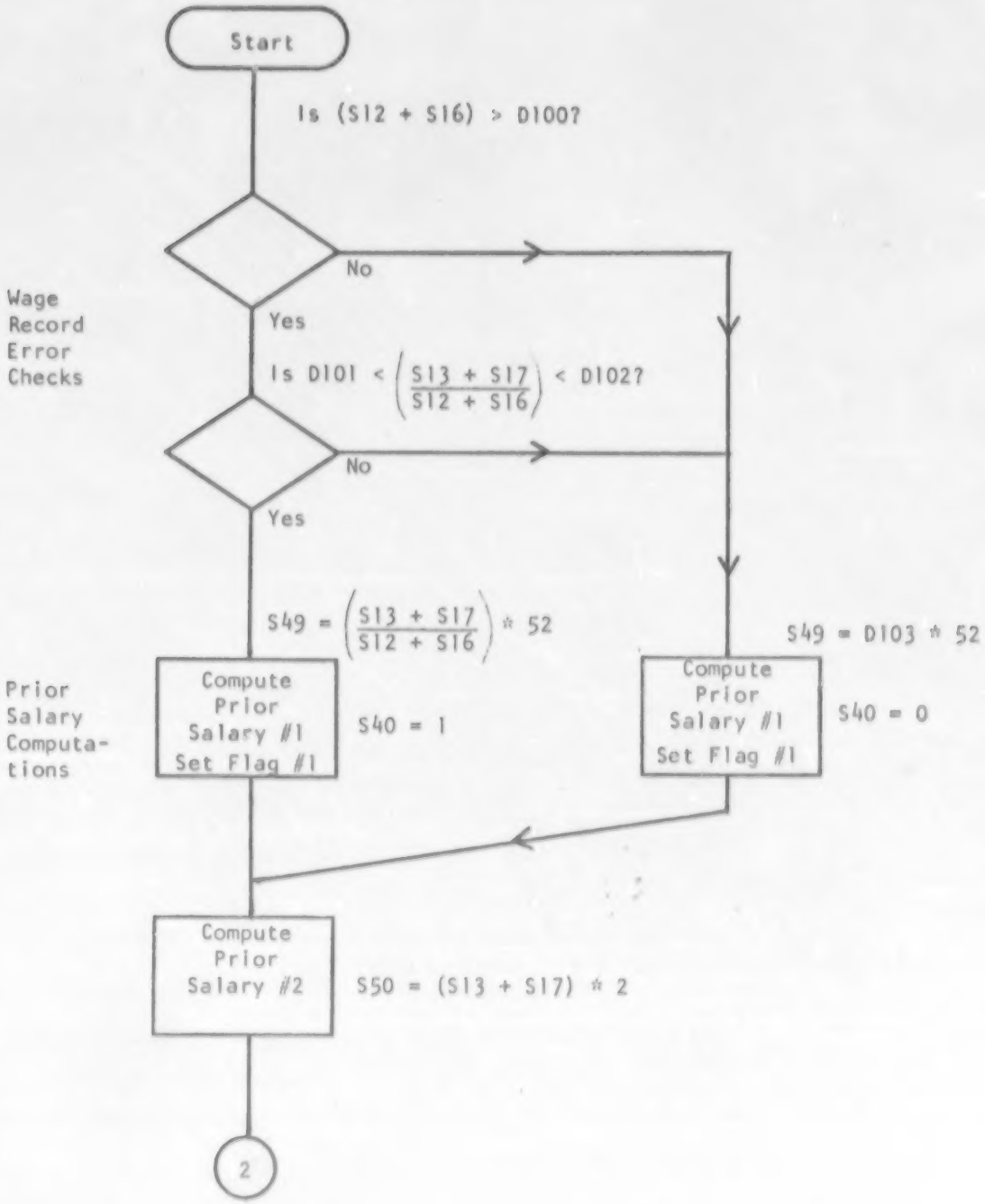
APPENDIX D

Computer Implementation
(Deleted - See Master Copy)

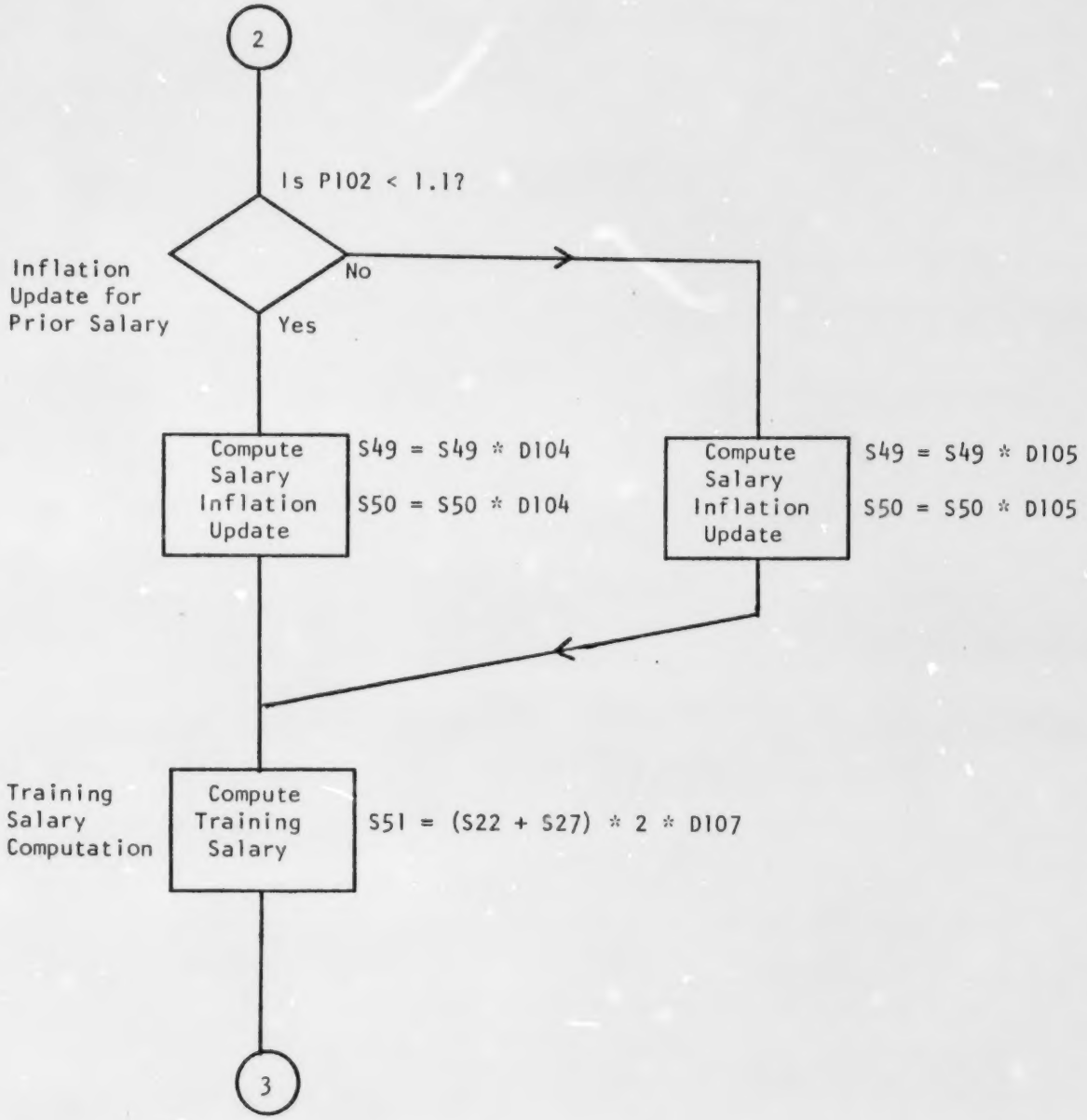
APPENDIX E

COMPUTATION ROUTINES LOGIC

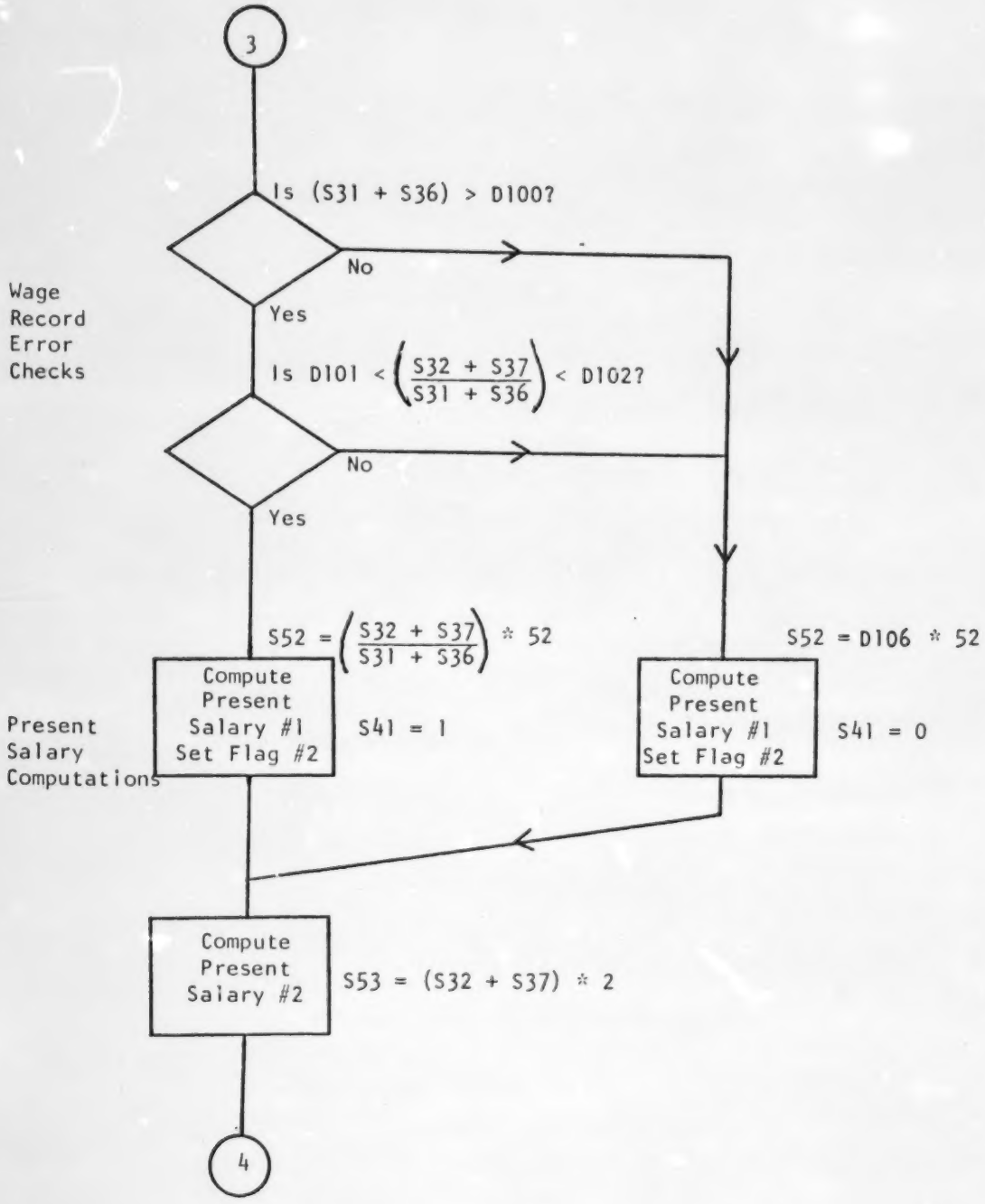
Vocational Cost-Benefit System
Computation Routines Logic
Individual Student Data Computations

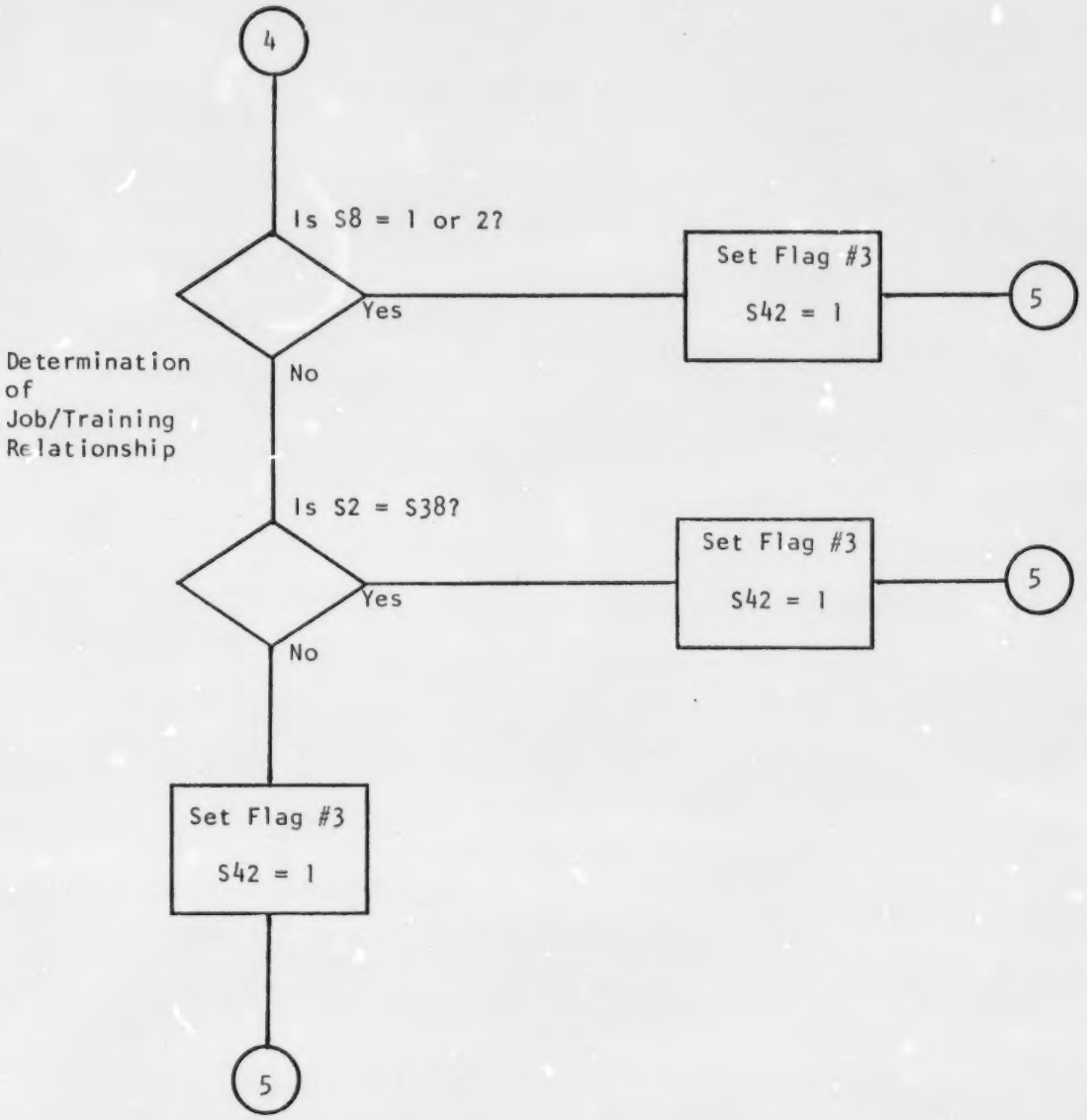

Start
Is (S12 + S16) > D100?
No
Yes
Wage Record Error Checks
Is D101 < (S13 + S17)/(S12 + S16) < D102?
No
Yes
S49 = (S13 + S17)/(S12 + S16) * 52
S49 = D103 * 52
Prior Salary Computations
Compute Prior Salary #1 Set Flag #1
S40 = 1
Compute Prior Salary #1 Set Flag #1
S40 = 0
Compute Prior Salary #2
S50 = (S13 + S17) * 2
2

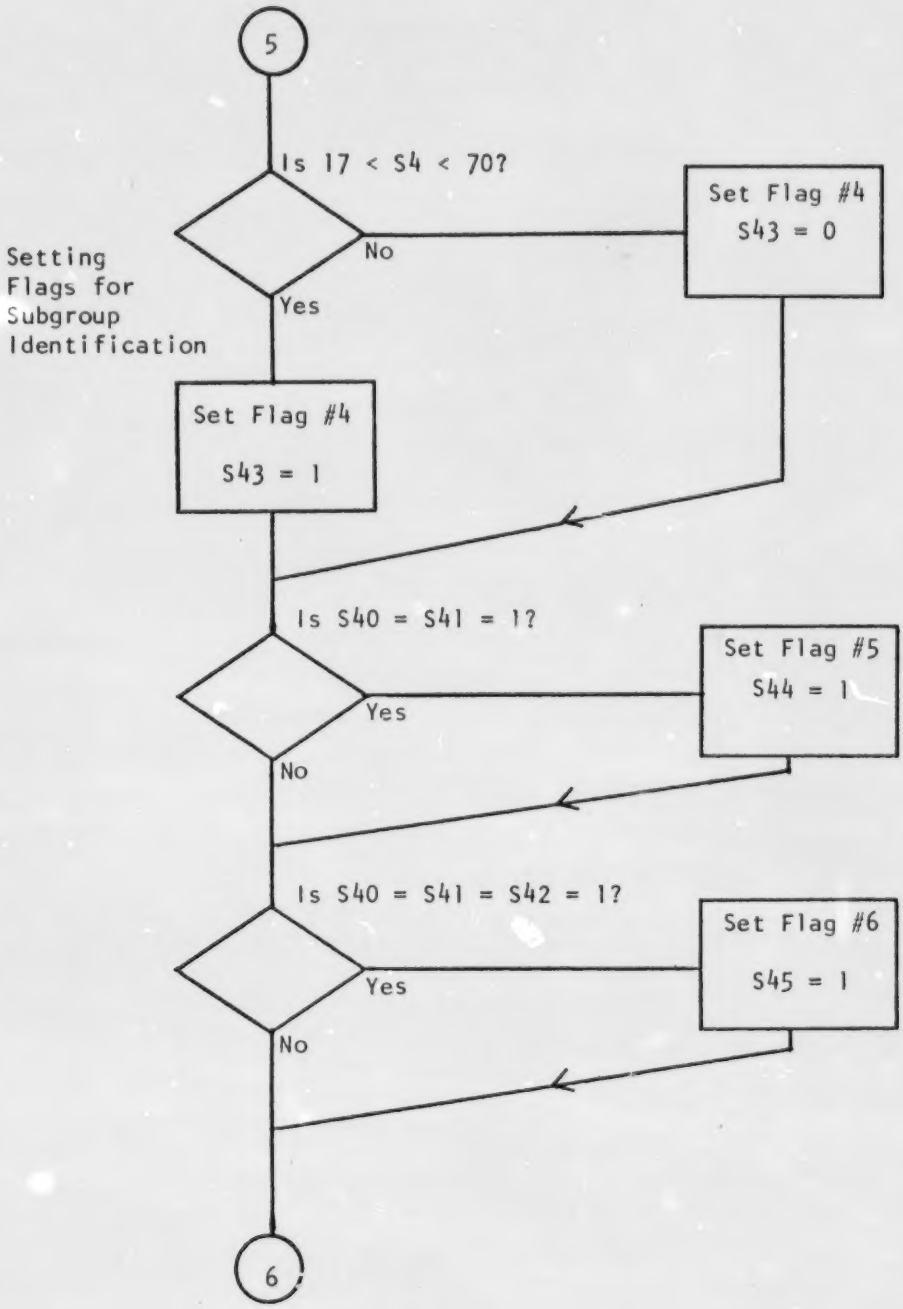
Individual Student Data Computations



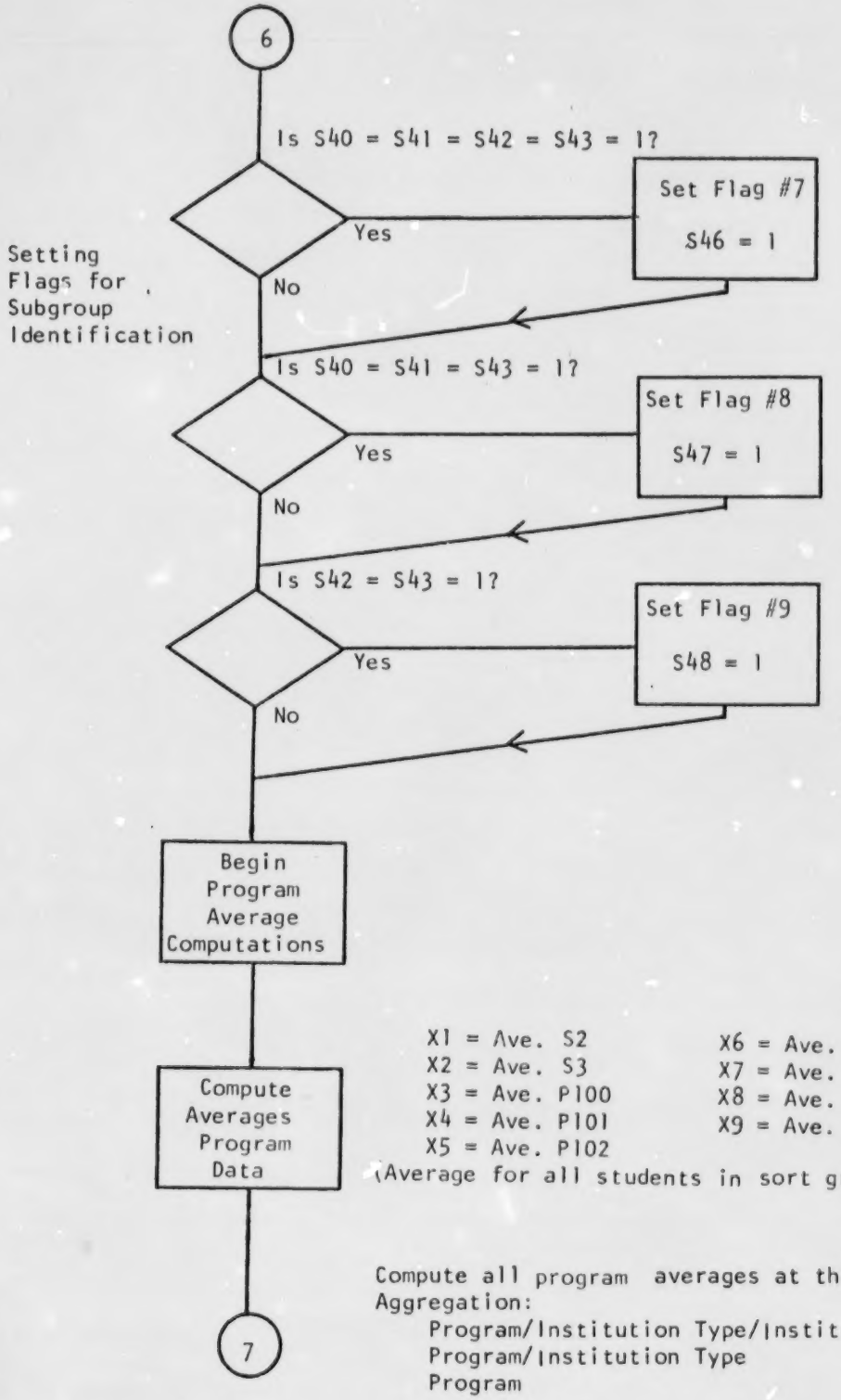
Individual Student Data Computations


3
Is (S31 + S36) > D100?
No
Yes
Wage Record Error Checks
Is D101 < (S32 + S37)/(S31 + S36) < D102?
No
Yes
S52 = (S32 + S37)/(S31 + S36) * 52
S52 = D106 * 52
Compute Present Salary #1 Set Flag #2
S41 = 1
Compute Present Salary #1 Set Flag #2
S41 = 0
Present Salary Computations
Compute Present Salary #2
S53 = (S32 + S37) * 2
4


4
Is S8 = 1 or 2?
Yes
Set Flag #3
S42 = 1
5
Determination
of
Job/Training
Relationship
No
Is S2 = S38?
Yes
Set Flag #3
S42 = 1
5
No
Set Flag #3
S42 = 1
5


5
Is 17 < S4 < 70?
No
Yes
Set Flag #4
S43 = 0
Setting
Flags for
Subgroup
Identification
Set Flag #4
S43 = 1
Is S40 = S41 = 1?
Yes
No
Set Flag #5
S44 = 1
Is S40 = S41 = S42 = 1?
Yes
No
Set Flag #6
S45 = 1
6

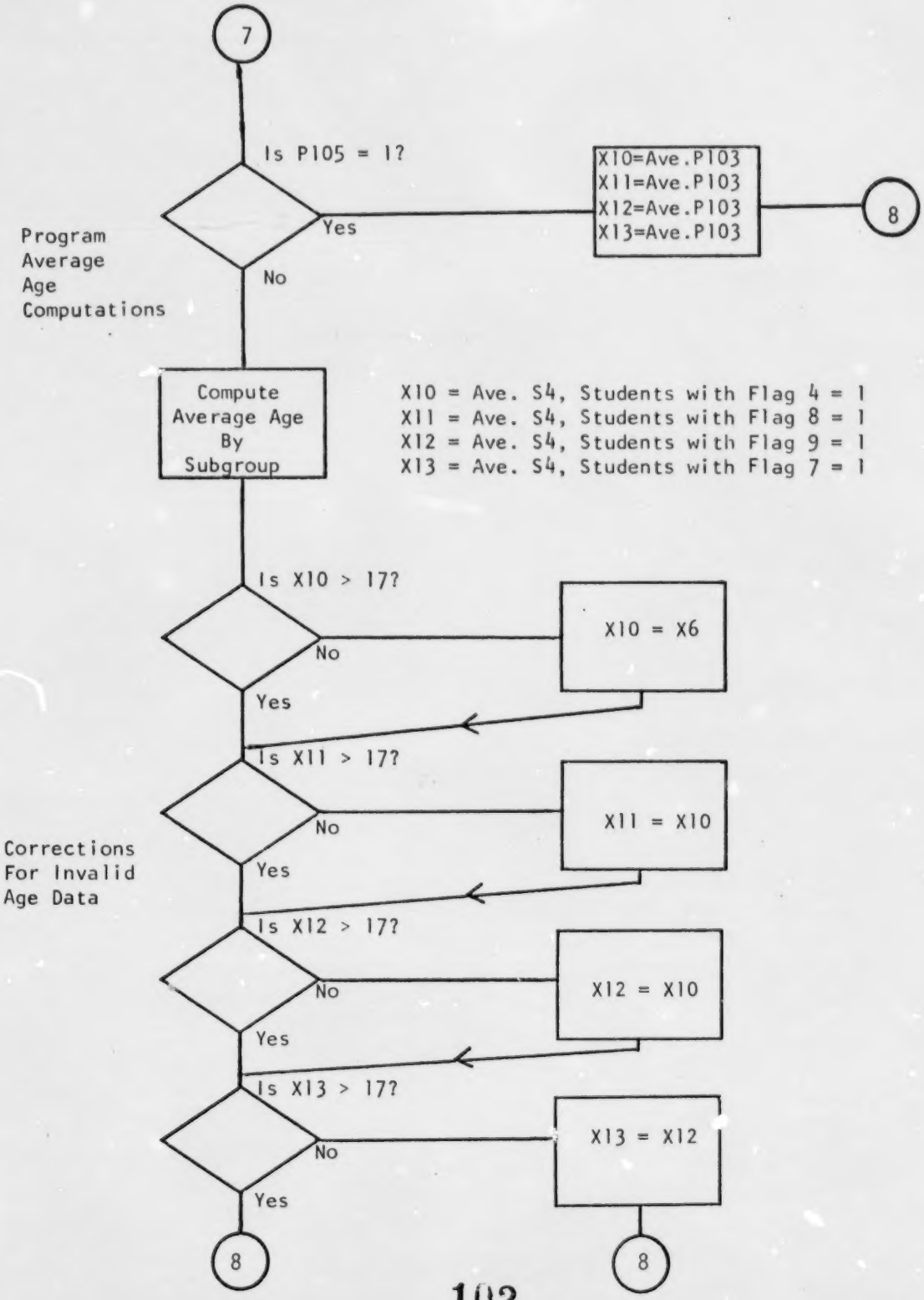
Individual Student Data Computations
Program Average Computations



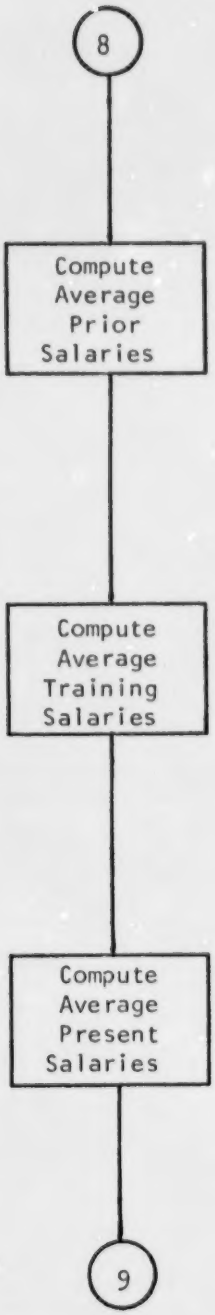
X1 = Ave. S2
X2 = Ave. S3
X3 = Ave. P100
X4 = Ave. P101
X5 = Ave. P102
X6 = Ave. P103
X7 = Ave. P104
X8 = Ave. P105
X9 = Ave. S10
(Average for all students in sort grouping)

Compute all program averages at three levels of Aggregation:
Program/Institution Type/Institution
Program/Institution Type
Program

Program Average Computations



Program Average Computations



X14 = Ave. S49, All Program Students
X15 = Ave. S49, Flag 5 = 1 Students
X16 = Ave. S50, All Program Students
X17 = Ave. S50, Flag 5 = 1 Students
X18 = Ave. S49, Flag 3 = 1 Students
X19 = Ave. S49, Flag 6 = 1 Students
X20 = Ave. S50, Flag 3 = 1 Students
X21 = Ave. S50, Flag 6 = 1 Students

X22 = Ave. S51, All Program Students
X23 = Ave. S51, Flag 5 = 1 Students
X24 = Ave. S51, Flag 3 = 1 Students
X25 = Ave. S51, Flag 6 = 1 Students

X26 = Ave. S52, All Program Students
X27 = Ave. S52, Flag 5 = 1 Students
X28 = Ave. S53, All Program Students
X29 = Ave. S53, Flag 5 = 1 Students
X30 = Ave. S52, Flag 3 = 1 Students
X31 = Ave. S52, Flag 6 = 1 Students
X32 = Ave. S53, Flag 3 = 1 Students
X33 = Ave. S53, Flag 6 = 1 Students

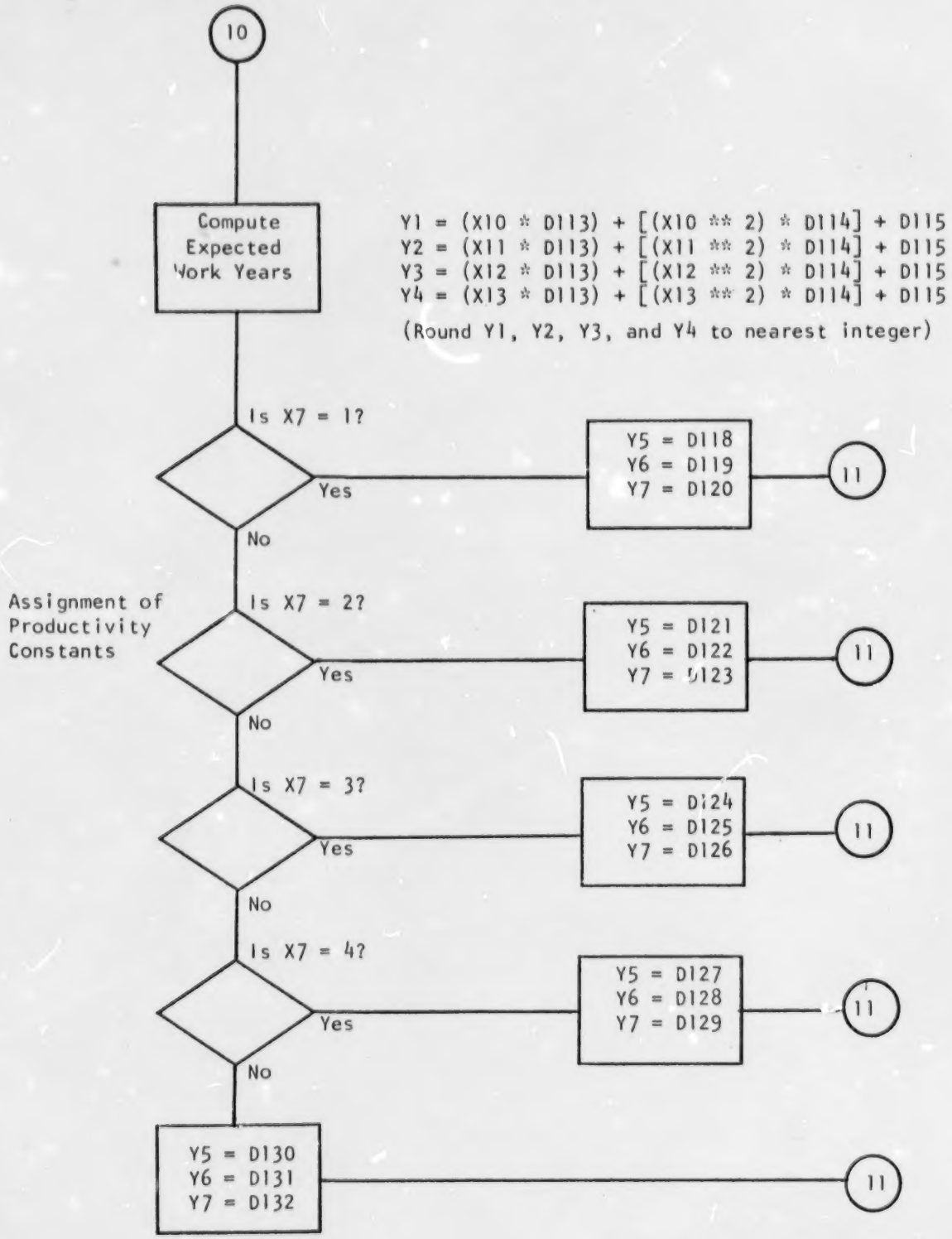
Program Average Computations

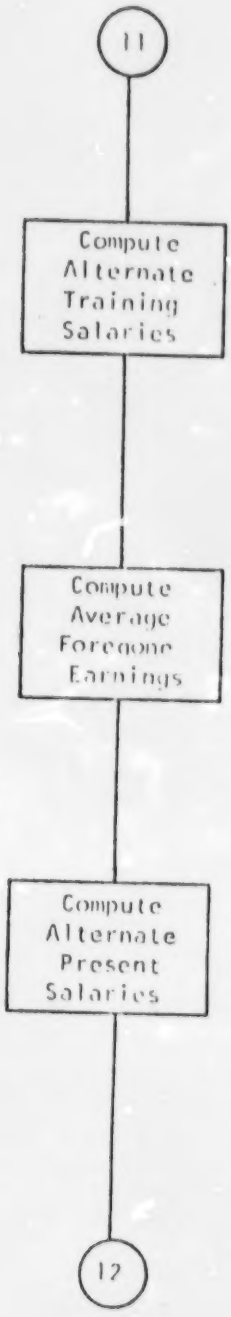
X34 = Total Number of Students in Prog./Institution
X35 = Number of Students, Flag 1 = 1
X36 = Number of Students, Flag 2 = 1
X37 = Number of Students, Flag 3 = 1
X38 = Number of Students, Flag 4 = 1
X39 = Number of Students, Flag 5 = 1
X40 = Number of Students, Flag 6 = 1
X41 = Number of Students, Flag 7 = 1
X42 = Number of Students, Flag 8 = 1
X43 = Number of Students, Fiag 9 = 1

D110 on Program Master File = Ave. D110 on Student File
.
.
.
.
D133 on Program Master File = Ave. D133 on Student File

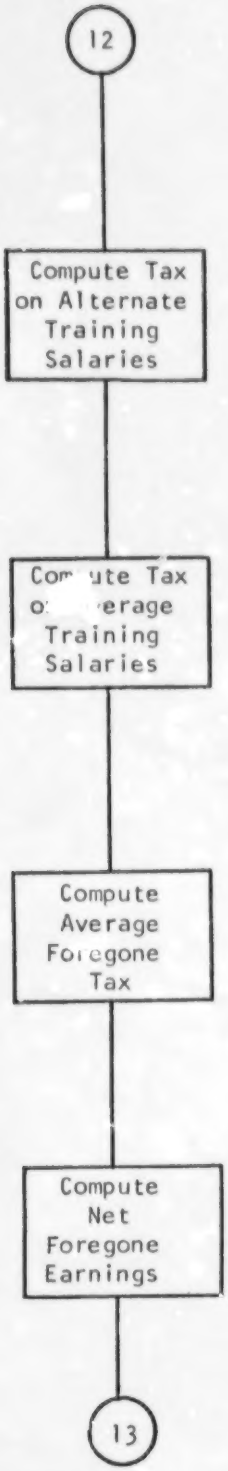
(End of Program-By-Institution Average Computations From Student Master File)

Benefit-Cost Ratio Computations





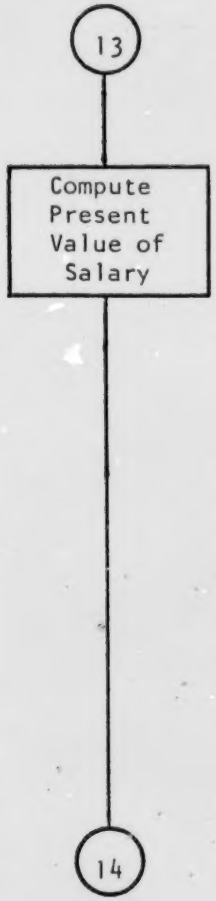

```
Y8 = X14 * [((X10 - 1) * D118) + (((X10 - 1) ** 2)
  D119) + D120]
Y9 = X15 * [((X11 - 1) * D118) + (((X11 - 1) ** 2)
  D119) + D120]
Y10 = X16 * [((X10 - 1) * D118) + (((X10 - 1) ** 2)
  D119) + D120]
Y11 = X17 * [((X11 - 1) * D118) + (((X11 - 1)    2)
  D119) + D120]
Y12 = X18 * [((X12 - 1) * D118) + (((X12 - 1)    2)
  D119) + D120]
Y13 = X19 * [((X13 - 1) * D118) + (((X13 - 1) ** 2)
  D119) + D120]
Y14 = X20 * [((X12 - 1) * D118) + (((X12 - 1)    2)
  D119) + D120]
Y15 = X21 * [((X13 - 1) * D118) + (((X13 - 1) ** 2)
  D119) + D120]

Y16 = (Y8 - X22)
Y17 = (Y9 - X23)
Y18 = (Y10 - X22)
Y19 = (Y11 - X23)

Y20 = (Y12 - X22)
Y21 = (Y13 - X23)
Y22 = (Y14 - X22)
Y23 = (Y15 - X23)

Y24 = Y8 * [(X10 * D118) + ((X10 ** 2) * D119) + D120]
Y25 = Y9 * [(X11 * D118) + ((X11 ** 2) * D119) + D120]
Y26 = Y10 * [(X10 * D118) + ((X10 ** 2) * D119) + D120
Y27 = Y11 * [(X11 * D118) + ((X11 ** 2) * D119) + D120
Y28 = Y12 * [(X12 * D118) + ((X12 ** 2) * D119) + D120
Y29 = Y13 * [(X13 * D118) + ((X13 ** 2) * D119) + D120
Y30 = Y14 * [(X12 * D118) + ((X12 ** 2) * D119) + D120
Y31 = Y15 * [(X13 * D118) + ((X13 ** 2) * D119) + D120
```




```
Y32 = (Y8 * D110) + ((Y8 ** 2) * D111) + D112
Y33 = (Y9 * D110) + ((Y9 ** 2) * D111) + D112
Y34 = (Y10 * D110) + ((Y10 ** 2) * D111) + D112
Y35 = (Y11 * D110) + ((Y11 ** 2) * D111) + D112
Y36 = (Y12 * D110) + ((Y12 ** 2) * D111) + D112
Y37 = (Y13 * D110) + ((Y13 ** 2) * D111) + D112
Y38 = (Y14 * D110) + ((Y14 ** 2) * D111) + D112
Y39 = (Y15 * D110) + ((Y15 ** 2) * D111) + D112

Y40 = (X22 * D110) + ((X22 ** 2) * D111) + D112
Y41 = (X23 * D110) + ((X23 ** 2) * D111) + D112
Y42 = (X24 * D110) + ((X24 ** 2) * D111) + D112
Y43 = (X25 * D110) + ((X25 ** 2) * D111) + D112

Y44 = Y32 - Y40
Y45 = Y33 - Y41
Y46 = Y34 - Y40
Y47 = Y35 - Y41
Y48 = Y36 - Y42
Y49 = Y37 - Y43
Y50 = Y38 - Y42
Y51 = Y39 - Y43

Y52 = Y16 - Y44
Y53 = Y17 - Y45
Y54 = Y18 - Y46
Y55 = Y19 - Y47
Y56 = Y20 - Y48
Y57 = Y21 - Y49
Y58 = Y22 - Y50
Y59 = Y23 - Y51
```

Note: Y52 to Y59
If net foregone earning is less than zero, set net foregone earnings equal to zero.

Benefit-Cost Ratio Computations



where n = year:

$$Y60 = \sum_{n=1}^{Y1} [(Y24 * (D116 + ((X10 + n-1) * D118) + (((X10 + n-1) ** 2) * D119) + D120)^{n})/(1 + D117)$$

$$Y61 = \sum_{n=1}^{Y2} [(Y25 \quad X11 \quad X11$$

$$Y62 = \sum_{n=1}^{Y1} [(Y26 \quad X10 \quad X10$$

$$Y63 = \sum_{n=1}^{Y2} [(Y27 \quad X11 \quad X11$$

$$Y64 = \sum_{n=1}^{Y3} [(Y28 \quad X12 \quad X12$$

$$Y65 = \sum_{n=1}^{Y4} [(Y29 \quad X13 \quad X13$$

$$Y66 = \sum_{n=1}^{Y3} [(Y30 \quad X12 \quad X12$$

$$Y67 = \sum_{n=1}^{Y4} [(Y31 \quad X13 \quad X13$$

(Present Value of Salary Computations--Continued)

$$Y68 = \sum_{n=1}^{Y1} [(X26 * (D116 + ((X10 + n-1) * Y5) + (((X10 + n=1) ** 2) * Y6) + Y7)^{n})/(1 + D117)^{n}]$$

$$Y69 = \sum_{n=1}^{Y2} X27 \qquad X11 \qquad X11$$

$$Y70 = \sum_{n=1}^{Y1} X28 \qquad X10 \qquad X10$$

$$Y71 = \sum_{n=1}^{Y2} X29 \qquad X11 \qquad X11$$

$$Y72 = \sum_{n=1}^{Y3} X30 \qquad X12 \qquad X12$$

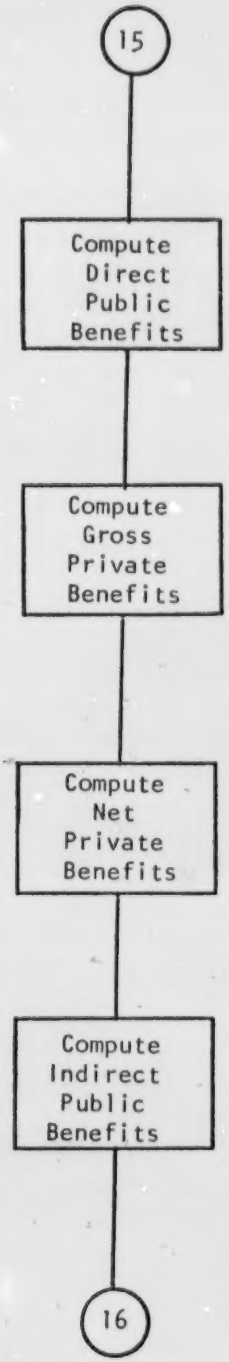
$$Y73 = \sum_{n=1}^{Y4} X31 \qquad X13 \qquad X13$$

$$Y74 = \sum_{n=1}^{Y3} X32 \qquad X12 \qquad X12$$

$$Y75 = \sum_{n=1}^{Y4} X33 \qquad X13 \qquad X13$$

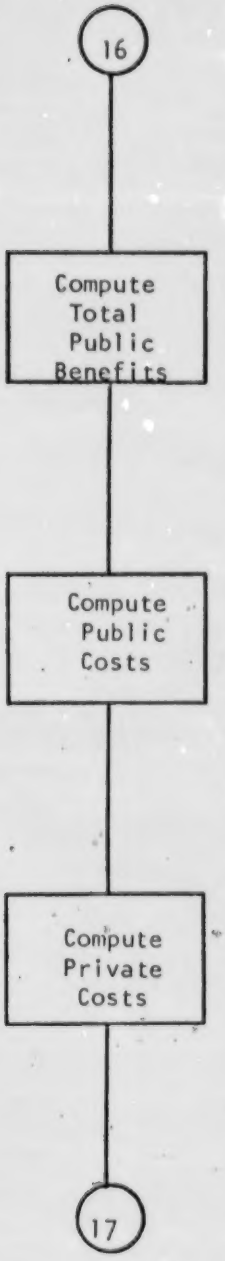
```
Y76 = [(Y24 * D110) + ((Y24 ** 2) * D111) + D112]/Y24
Y77 = [(Y25 * D110) + ((Y25 ** 2) * D111) + D112]/Y25
Y78 =   Y26                 Y26                         Y26
Y79 =   Y27                 Y27                         Y27
Y80 =   Y28                 Y28                         Y28
Y81 =   Y29                 Y29                         Y29
Y82 =   Y30                 Y30                         Y30
Y83 =   Y31                 Y31                         Y31
Y84 =   X26                 X26                         X26
Y85 =   X27                 X27                         X27
Y86 =   X28                 X28                         X28
Y87 =   X29                 X29                         X29
Y88 =   X30                 X30                         X30
Y89 =   X31                 X31                         X31
Y90 =   X32                 X32                         X32
Y91 =   X33                 X33                         X33
```

```
Y92 = Y60 * Y76
Y93 = Y61 * Y77
Y94 = Y62 * Y78
Y95 = Y63 * Y79
Y96 = Y64 * Y80
Y97 = Y65 * Y81
Y98 = Y66 * Y82
Y99 = Y67 * Y83
Y100= Y68 * Y84
Y101= Y69 * Y85
Y102= Y70 * Y86
Y103= Y71 * Y87
Y104= Y72 * Y88
Y105= Y73 * Y89
Y106= Y74 * Y90
Y107= Y75 * Y91
```




```
Y108 = Y100 - Y92
Y109 = Y101 - Y93
Y110 = Y102 - Y94
Y111 = Y103 - Y95
Y112 = Y104 - Y96
Y113 = Y105 - Y97
Y114 = Y106 - Y98
Y115 = Y107 - Y99

Y116 = Y68 - Y60
Y117 = Y69 - Y61
Y118 = Y70 - Y62
Y119 = Y71 - Y63
Y120 = Y72 - Y64
Y121 = Y73 - Y65
Y122 = Y74 - Y66
Y123 = Y75 - Y67

Y124 = Y116 - Y108
Y125 = Y117 - Y109
Y126 = Y118 - Y110
Y127 = Y119 - Y111
Y128 = Y120 - Y112
Y129 = Y121 - Y113
Y130 = Y122 - Y114
Y131 = Y123 - Y115

Y132 = Y116 * D133
Y133 = Y117 * D133
Y134 = Y118 * D133
Y135 = Y119 * D133
Y136 = Y120 * D133
Y137 = Y121 * D133
Y138 = Y122 * D133
Y139 = Y123 * D133
```

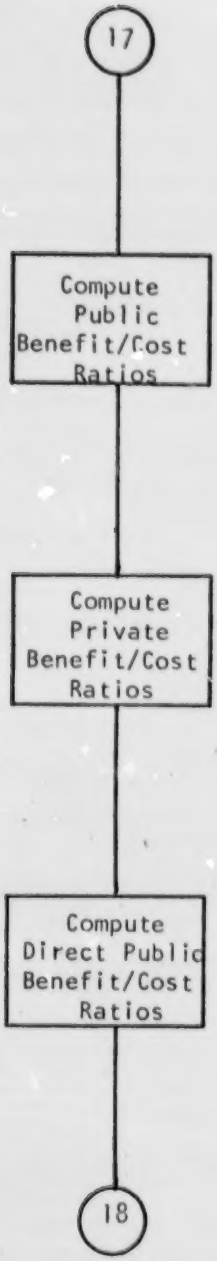
Benefit/Cost Ratio Computations



Y140 = Y108 + Y132
Y141 = Y109 + Y133
Y142 = Y110 + Y134
Y143 = Y111 + Y135
Y144 = Y112 + Y136
Y145 = Y113 + Y137
Y146 = Y114 + Y138
Y147 = Y115 + Y139

Y148 = X3 + Y44
Y149 = X3 + Y45
Y150 = X3 + Y46
Y151 = X3 + Y47
Y152 = X3 + Y48
Y153 = X3 + Y49
Y154 = X3 + Y50
Y155 = X3 + Y51

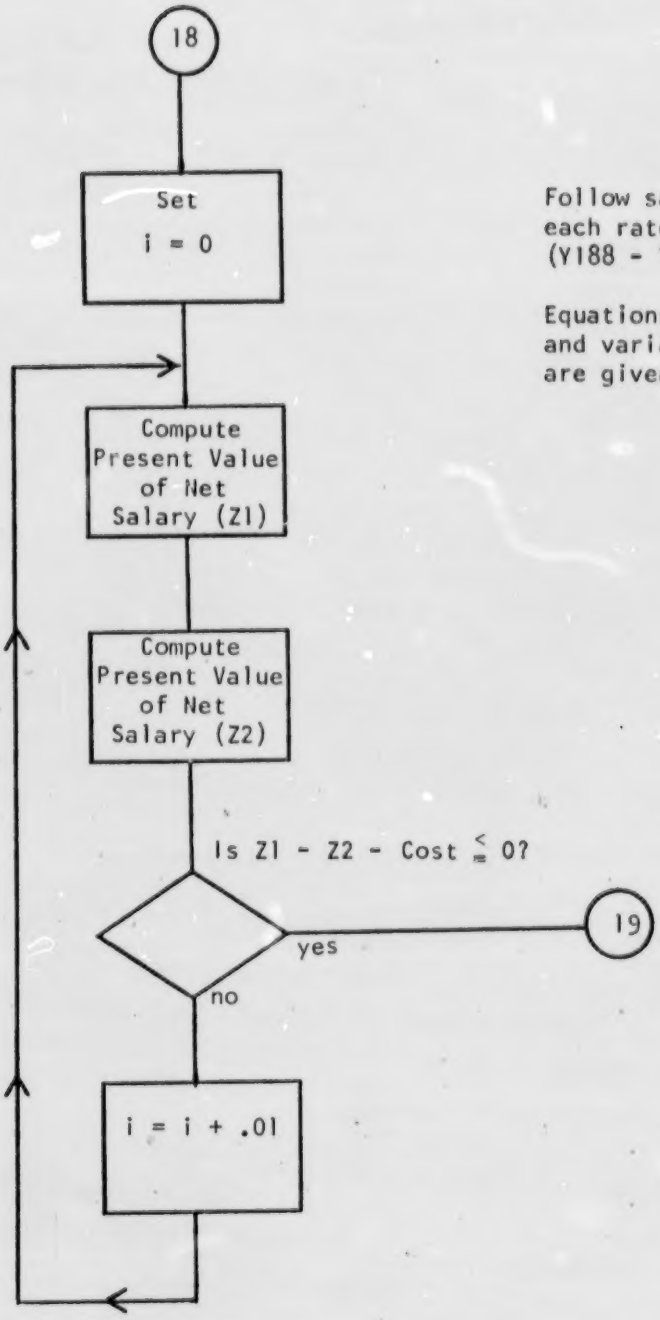
Y156 = X4 + Y52
Y157 = X4 + Y53
Y158 = X4 + Y54
Y159 = X4 + Y55
Y160 = X4 + Y56
Y161 = X4 + Y57
Y162 = X4 + Y58
Y163 = X4 + Y59



Y164 = Y140/Y148
Y165 = Y141/Y149
Y166 = Y142/Y150
Y167 = Y143/Y151
Y168 = Y144/Y152
Y169 = Y145/Y153
Y170 = Y146/Y154
Y171 = Y147/Y155

Y172 = Y124/Y156
Y173 = Y125/Y157
Y174 = Y126/Y158
Y175 = Y127/Y159
Y176 = Y128/Y160
Y177 = Y129/Y161
Y178 = Y130/Y162
Y179 = Y131/Y163

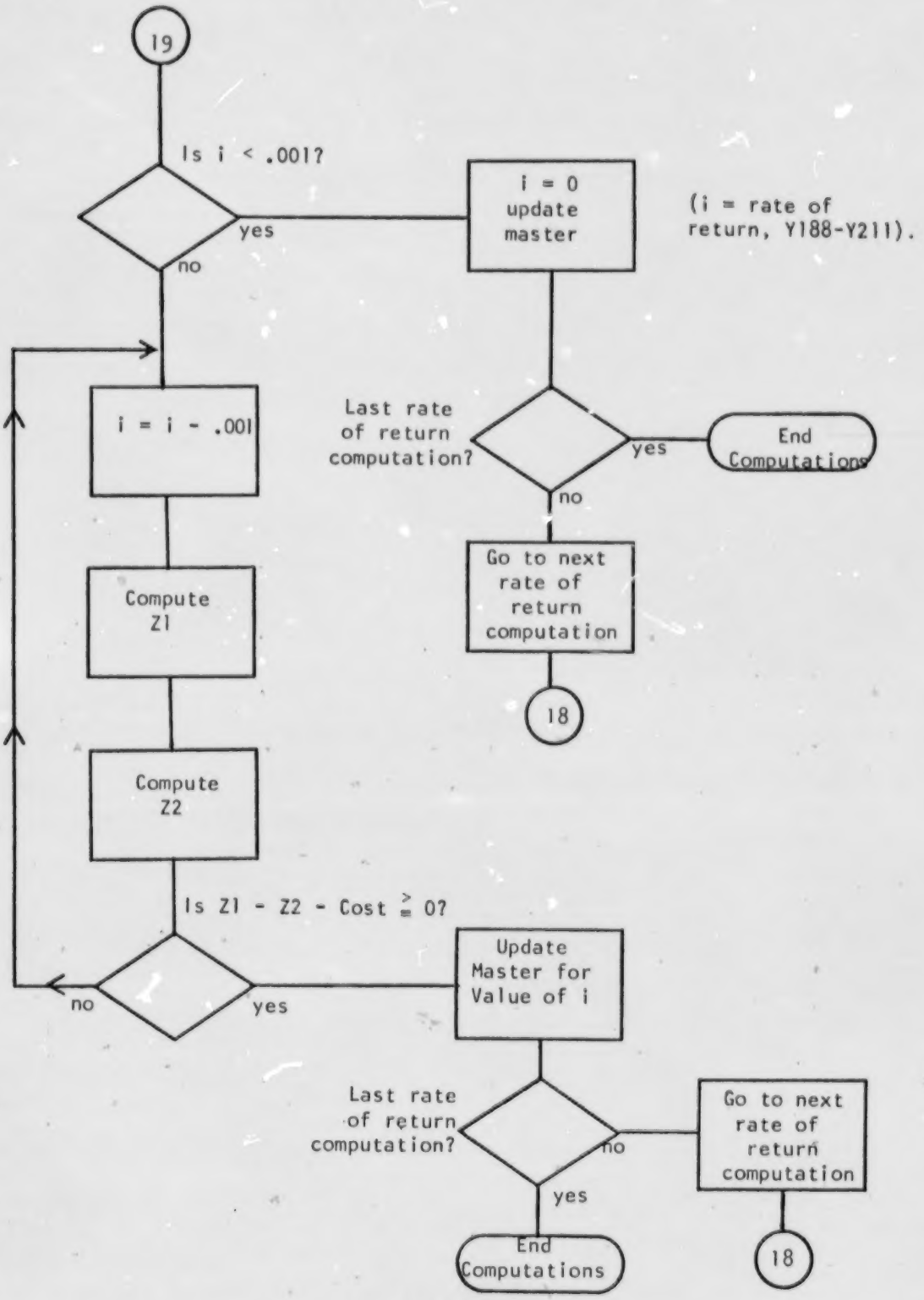
Y180 = Y108/Y148
Y181 = Y109/Y149
Y182 = Y110/Y150
Y183 = Y111/Y151
Y184 = Y112/Y152
Y185 = Y113/Y153
Y186 = Y114/Y154
Y187 = Y115/Y155



Follow same computation logic for each rate of return computation (Y188 - Y211).

Equations for computing Z1 and Z2 and variables used in the equations are given on page 20.

Rate of Return Computations



Rate of Return Computations

Equations for calculating Z1 and Z2 for each rate of return computation are given below. The basic equation is the same for all rate of return computations (Y188 - Y211), but the variables used in the equations change as indicated in the table below.

For Y188:

$$Z1 = \sum_{n=1}^{Y1} [((X26 * (D116 + ((X10 + n-1) * Y5) + (((X10 + n-1) ** 2) * Y6) + Y7) ** n) * (1 - Y84))/(1 + i) ** n]$$

$$Z2 = \sum_{n=1}^{Y1} [((Y24 * (D116 * (X10 + n-1) * D118) + (((X10 + n-1) ** 2) * D119) + D120) ** n) * (1 - Y76))/(1 + i) ** n]$$

where n = year

Variables Used in Rate of Return Computations

Rate of Return	Work Years	Ave.Present Salary	Alt.Present Salary	Ave. Age	Tax Factor for Z1	Tax Factor for Z2	Cost
Y188	Y1	X26	Y24	X10	1 - Y84	1 - Y76	Y156
Y189	Y2	X27	Y25	X11	1 - Y85	1 - Y77	Y157
Y190	Y1	X28	Y26	X10	1 - Y86	1 - Y78	Y158
Y191	Y2	X29	Y27	X11	1 - Y87	1 - Y79	Y159
Y192	Y3	X30	Y28	X12	1 - Y88	1 - Y80	Y160
Y193	Y4	X31	Y29	X13	1 - Y89	1 - Y81	Y161
Y194	Y3	X32	Y30	X12	1 - Y90	1 - Y82	Y162
Y195	Y4	X33	Y31	X13	1 - Y91	1 - Y83	Y163

Variables Used in Rate of Return Computations (continued)

Rate of Return	Work Years	Ave.Present Salary	Alt.Present Salary	Ave. Age	Tax Factor for Z1	Tax Factor for Z2	Cost
Y196	Y1	X26	Y24	X10	Y84	Y76	X3
Y197	Y2	X27	Y25	X11	Y85	Y77	X3
Y198	Y1	X28	Y26	X10	Y86	Y78	X3
Y199	Y2	X29	Y27	X11	Y87	Y79	X3
Y200	Y3	X30	Y28	X12	Y88	Y80	X3
Y201	Y4	X31	Y29	X13	Y89	Y81	X3
Y202	Y3	X32	Y30	X12	Y90	Y82	X3
Y203	Y4	X33	Y31	X13	Y91	Y83	X3
Y204	Y1	X26	Y24	X10	D133	D133	Y148
Y205	Y2	X27	Y25	X11	D133	D133	Y149
Y206	Y1	X28	Y26	X10	D133	D133	Y150
Y207	Y2	X29	Y27	X11	D133	D133	Y151
Y208	Y3	X30	Y28	X12	D133	D133	Y152
Y209	Y4	X31	Y29	X13	D133	D133	Y153
Y210	Y3	X32	Y30	X12	D133	D133	Y154
Y211	Y4	X33	Y31	X13	D133	D133	Y155

APPENDIX F

Student Master File, Definitions and Sample Listing
(Deleted - See Master Copy)

APPENDIX G

Program Master File
(Deleted - See Master Copy)

APPENDIX H

SUMMARY REPORT

CALCULATION OF
BENEFIT-COST RATIOS AND RATES OF RETURN

FLORIDA DEPARTMENT OF EDUCATION
VOCATIONAL EDUCATION COST-BENEFIT SYSTEM
COMPUTATION OF COST-BENEFIT RATIOS AND RATES OF RETURN

PROGRAM: 3043--LICENSED PRACTICAL NURSING INSTITUTION TYPE: ALL INSTITUTION: ALL

WAGE MODEL: FULL EMPLOYMENT

DESCRIPTION (PROGRAM AVERAGES)	SUBGROUP OF PROGRAM COMPLETERS			
	ALL COMPLETERS	COMPLETERS WITH VALID WAGE DATA	COMPLETERS IN JOB FOR WHICH TRAINED	COMPLETERS WITH VALID WAGE DATA AND IN JOB FOR WHICH TRAINED
NUMBER OF INDIVIDUALS	168	43	137	37
PRETRAINING SALARY	$5,965.44	$5,988.67	$5,887.88	$5,982.67
TRAINING PERIOD SALARY	$2,225.05	$2,243.73	$2,164.89	$2,094.77
POST-TRAINING SALARY	$7,099.92	$7,690.60	$7,222.56	$7,322.95
DIRECT PRIVATE COST	$480.85	$480.85	$480.85	$480.85
DIRECT PUBLIC COST	$4,477.01	$4,477.01	$480.85	$4,477.01
AGE	30	28	31	13
EXPECTED WORK YEARS	32	34	32	33
PRESENT VALUE OF LIFETIME SALARY				
WITHOUT TRAINING	$195,780.80	$212,659.92	$193,286.56	$204,214.95
WITH TRAINING	$222,758.47	$257,773.85	$226,816.77	$236,566.21
PRESENT VALUE OF LIFETIME TAXES				
WITHOUT TRAINING	$36,934.43	$40,185.90	$36,414.55	$38,575.75
WITH TRAINING	$42,619.42	$49,813.55	$43,485.18	$45,431.05
GROSS PRIVATE BENEFIT	$26,977.67	$45,113.93	$33,530.21	$32,351.26
NET PRIVATE BENEFIT	$21,292.68	$39,496.28	$26,459.57	$25,495.95
DIRECT PUBLIC BENEFIT	$5,694.99	$9,627.65	$7,070.63	$6,855.30
INDIRECT PUBLIC BENEFIT	$134,888.35	$225,569.66	$167,651.04	$161,756.28
TOTAL PUBLIC BENEFIT	$140,573.34	$235,197.32	$174,721.67	$168,611.59
PRIVATE COST	$3,622.49	$3,657.93	$3,607.35	$3,769.03
PUBLIC COST	$5,220.91	$5,230.83	$5,214.72	$5,254.04
PRIVATE BENEFIT-COST RATIO	5.878	9.701	7.335	6.765
DIRECT PUBLIC BENEFIT-COST RATIO	1.089	1.841	1.356	1.305
TOTAL PUBLIC BENEFIT-COST RATIO	26.925	44.964	33.505	32.092
PRIVATE RATE OF RETURN	25.500	37.400	30.700	28.300
DIRECT PUBLIC RATE OF RETURN	7.200	11.100	8.800	8.500
TOTAL PUBLIC RATE OF RETURN	95.000	146.400	116.600	109.900

PROGRAM: 3043--LICENSED PRACTICAL NURSING INSTITUTION TYPE: ALL INSTITUTION: ALL

WAGE MODEL: VARIABLE EMPLOYMENT

DESCRIPTION (PROGRAM AVERAGES)	SUBGROUP OF PROGRAM COMPLETERS			
	ALL COMPLETERS	COMPLETERS WITH VALID WAGE DATA	COMPLETERS IN JOB FOR WHICH TRAINED	COMPLETERS WITH VALID WAGE DATA AND IN JOB FOR WHICH TRAINED
NUMBER OF INDIVIDUALS	168	43	137	37
PRETRAINING SALARY	$1,628.56	$3,325.81	$1,497.38	$3,247.73
TRAINING PERIOD SALARY	$2,225.05	$2,243.73	$2,164.89	$2,094.77
POST-TRAINING SALARY	$3,847.94	$5,202.97	$4,407.10	$5,155.55
DIRECT PRIVATE COST	$480.85	$480.85	$480.85	$480.85
DIRECT PUBLIC COST	$4,477.01	$4,477.01	$4,477.01	$4,477.01
AGE	30	28	31	29
EXPECTED WORK YEARS	32	34	32	33
PRESENT VALUE OF LIFETIME SALARY				
WITHOUT TRAINING	$53,449.12	$118,100.67	$49,155.85	$110,859.38
WITH TRAINING	$130,728.35	$177,410.08	$138,400.44	$166,549.01
PRESENT VALUE OF LIFETIME TAXES				
WITHOUT TRAINING	$9,899.33	$21,524.04	$9,161.99	$20,192.79
WITH TRAINING	$22,058.80	$32,988.86	$25,435.75	$30,908.71
GROSS PRIVATE BENEFIT	$67,280.23	$59,309.41	$89,244.60	$55,689.63
NET PRIVATE BENEFIT	$55,120.76	$47,844.59	$72,970.84	$44,973.71
DIRECT PUBLIC BENEFIT	$12,159.48	$11,464.82	$16,273.76	$10,715.92
INDIRECT PUBLIC BENEFIT	$336,401.16	$296,547.04	$446,222.99	$278,448.13
TOTAL PUBLIC BENEFIT	$348,560.63	$308,011.86	$462,496.75	$289,164.05
PRIVATE COST	$480.85	$1,451.37	$480.85	$1,504.83
PUBLIC COST	$4,379.93	$4,691.78	$4,367.37	$4,702.24
PRIVATE BENEFIT-COST RATIO	114.633	32.965	151.755	29.896
DIRECT PUBLIC BENEFIT-COST RATIO	2.776	2.444	3.726	2.279
TOTAL PUBLIC BENEFIT-COST RATIO	79.581	65.649	105.898	61.495
PRIVATE RATE OF RETURN	400.000	113.500	525.700	106.900
DIRECT PUBLIC RATE OF RETURN	13.800	12.800	17.400	12.400
TOTAL PUBLIC RATE OF RETURN	270.200	211.400	356.800	205.300

FLORIDA DEPARTMENT OF EDUCATION
VOCATIONAL EDUCATION COST-BENEFIT SYSTEM
COMPUTATION OF COST-BENEFIT RATIOS AND RATES OF RETURN

PROGRAM: 9013--AIR CON/HEAT MECH INSTITUTION TYPE: ALL INSTITUTION: ALL

WAGE MODEL: FULL EMPLOYMENT

DESCRIPTION (PROGRAM AVERAGES)	ALL COMPLETERS	SUBGROUP OF PROGRAM COMPLETERS: COMPLETERS WITH VALID WAGE DATA	SUBGROUP OF PROGRAM COMPLETERS: COMPLETERS IN JOB FOR WHICH TRAINED	SUBGROUP OF PROGRAM COMPLETERS: COMPLETERS WITH VALID WAGE DATA AND IN JOB FOR WHICH TRAINED
NUMBER OF INDIVIDUALS	27	5	19	3
PRETRAINING SALARY	$6,727.73	$11,066.59	$6,252.01	$8,562.48
TRAINING PERIOD SALARY	$3,469.65	$8,463.02	$3,110.08	$3,917.45
POST-TRAINING SALARY	$8,162.62	$12,208.30	$8,063.26	$9,573.46
DIRECT PRIVATE COST	$128.00	$128.00	$128.00	$128.00
DIRECT PUBLIC COST	$2,681.19	$2,681.19	$128.00	$2,681.19
AGE	34	31	34	13
EXPECTED WORK YEARS	29	32	29	33
PRESENT VALUE OF LIFETIME SALARY				
WITHOUT TRAINING	$195,182.26	$363,630.93	$182,796.66	$292,243.95
WITH TRAINING	$231,580.04	$386,960.73	$229,887.01	$309,597.26
PRESENT VALUE OF LIFETIME TAXES				
WITHOUT TRAINING	$37,419.23	$75,153.07	$34,579.94	$57,904.01
WITH TRAINING	$45,115.50	$81,010.05	$44,709.10	$61,813.16
GROSS PRIVATE BENEFIT	$35,397.77	$23,319.80	$47,090.34	$17,353.32
NET PRIVATE BENEFIT	$27,701.50	$17,462.82	$36,961.17	$13,344.17
DIRECT PUBLIC BENEFIT	$7,696.27	$5,856.98	$10,129.17	$4,009.14
INDIRECT PUBLIC BENEFIT	$176,988.86	$115,598.90	$235,451.71	$86,766.58
TOTAL PUBLIC BENEFIT	$184,685.12	$122,455.98	$245,580.88	$90,775.72
PRIVATE COST	$2,819.19	$2,313.28	$2,725.07	$4,001.85
PUBLIC COST	$3,349.85	$3,354.55	$3,313.27	$3,700.87
PRIVATE BENEFIT-COST RATIO	9.826	7.549	13.563	3.334
DIRECT PUBLIC BENEFIT-COST RATIO	2.297	1.746	3.057	1.083
TOTAL PUBLIC BENEFIT-COST RATIO	55.132	36.504	74.120	24.528
PRIVATE RATE OF RETURN	42.400	31.300	56.200	16.000
DIRECT PUBLIC RATE OF RETURN	15.200	11.500	18.900	8.300
TOTAL PUBLIC RATE OF RETURN	204.800	125.100	271.800	85.000

PROGRAM: 9013--AIR CONDITIONING MECH INSTITUTION TYPE: ALL INSTITUTION: ALL

WAGE MODEL: VARIABLE EMPLOYMENT

DESCRIPTION (PROGRAM AVERAGES)	SUBGROUP OF PROGRAM COMPLETERS			
	ALL COMPLETERS	COMPLETERS WITH VALID WAGE DATA	COMPLETERS IN JOB FOR WHICH TRAINED	COMPLETERS WITH VALID WAGE DATA AND IN JOB FOR WHICH TRAINED
NUMBER OF INDIVIDUALS	27	5	19	3
PRETRAINING SALARY	$2,346.11	$9,873.10	$1,530.93	$6,573.33
TRAINING PERIOD SALARY	$3,469.65	$8,463.02	$3,110.08	$3,917.45
POST-TRAINING SALARY	$5,345.69	$10,859.84	$5,934.68	$9,127.57
DIRECT PRIVATE COST	$128.00	$128.00	$128.00	$128.00
DIRECT PUBLIC COST	$2,611.19	$2,681.19	$2,691.19	$2,691.19
AGE	34	31	34	29
EXPECTED WORK YEARS	29	32	29	33
PRESENT VALUE OF LIFETIME SALARY				
WITHOUT TRAINING	$60,413.32	$324,414.57	$46,515.57	$224,352.53
WITH TRAINING	$151,661.39	$341,969.49	$169,200.31	$295,177.55
PRESENT VALUE OF LIFETIME TAXES				
WITHOUT TRAINING	$12,449.89	$65,603.51	$8,642.06	$42,808.37
WITH TRAINING	$28,222.48	$69,831.78	$31,766.83	$58,476.73
GROSS PRIVATE BENEFIT	$83,244.07	$17,554.92	$122,684.74	$70,825.03
NET PRIVATE BENEFIT	$57,485.48	$14,326.64	$99,559.98	$55,156.67
DIRECT PUBLIC BENEFIT	$15,792.58	$4,228.28	$23,124.77	$15,668.35
INDIRECT PUBLIC BENEFIT	$416,240.33	$87,774.59	$613,423.72	$354,125.13
TOTAL PUBLIC BENEFIT	$431,992.91	$92,002.87	$636,548.49	$369,793.48
PRIVATE COST	$128.00	$1,387.59	$128.00	$2,403.93
PUBLIC COST	$2,483.29	$3,059.23	$2,415.42	$3,251.91
PRIVATE BENEFIT-COST RATIO	527.308	9.604	777.412	22.944
DIRECT PUBLIC BENEFIT-COST RATIO	6.343	1.382	9.574	4.818
TOTAL PUBLIC BENEFIT-COST RATIO	173.960	30.074	263.536	113.716
PRIVATE RATE OF RETURN	1990.300	38.500	2915.400	83.300
DIRECT PUBLIC RATE OF RETURN	27.200	8.800	37.500	25.100
TOTAL PUBLIC RATE OF RETURN	636.800	104.300	956.000	371.100

PROGRAM: 0205--COSMETOLOGY INSTITUTION TYPE: ALL INSTITUTION: ALL

WAGE MODEL: FULL EMPLOYMENT

DESCRIPTION (PROGRAM AVERAGES)	SUBGROUP OF PROGRAM COMPLETERS			
	ALL COMPLETERS	COMPLETERS WITH VALID WAGE DATA	COMPLETERS IN JOB FOR WHICH TRAINED	COMPLETERS WITH VALID WAGE DATA AND IN JOB FOR WHICH TRAINED
NUMBER OF INDIVIDUALS	76	9	64	8
PRETRAINING SALARY	$6,096.76	$7,693.25	$6,154.15	$7,914.82
TRAINING PERIOD SALARY	$938.68	$2,485.40	$1,059.51	$2,643.99
POST-TRAINING SALARY	$5,970.64	$6,324.37	$5,916.92	$6,123.70
DIRECT PRIVATE COST	$197.82	$197.82	$197.82	$197.82
DIRECT PUBLIC COST	$1,910.63	$1,910.63	$197.82	$1,910.63
AGE	20	30	29	13
EXPECTED WORK YEARS	33	32	33	32
PRESENT VALUE OF LIFETIME SALARY				
WITHOUT TRAINING	$207,763.84	$252,037.70	$210,045.67	$259,634.19
WITH TRAINING	$192,993.85	$197,995.14	$191,541.54	$191,713.68
PRESENT VALUE OF LIFETIME TAXES				
WITHOUT TRAINING	$39,315.07	$49,035.33	$39,794.16	$50,695.03
WITH TRAINING	$36,237.37	$37,402.75	$35,951.40	$36,100.43
GROSS PRIVATE BENEFIT	$-14,869.98	$-54,041.56	$-18,504.13	$-67,920.51
NET PRIVATE BENEFIT	$-11,782.28	$-42,437.97	$-14,671.37	$-53,325.91
DIRECT PUBLIC BENEFIT	$-3,077.70	$-11,603.59	$-3,832.75	$-14,594.60
INDIRECT PUBLIC BENEFIT	$-74,299.92	$-273,207.73	$-32,520.64	$-339,602.53
TOTAL PUBLIC BENEFIT	$-77,377.62	$-284,811.35	$-96,353.40	$-354,197.13
PRIVATE COST	$4,528.97	$4,515.12	$4,478.05	$4,569.90
PUBLIC COST	$2,907.60	$2,984.97	$2,900.37	$3,009.02
PRIVATE BENEFIT-COST RATIO	-2.602	-9.399	-3.276	-11.669
DIRECT PUBLIC BENEFIT-COST RATIO	-1.059	-3.887	-1.321	-4.850
TOTAL PUBLIC BENEFIT-COST RATIO	-26.613	-94.410	-33.221	-117.712
PRIVATE RATE OF RETURN	0.000	0.000	0.000	0.000
DIRECT PUBLIC RATE OF RETURN	0.000	0.000	0.000	0.000
TOTAL PUBLIC RATE OF RETURN	0.000	0.000	0.000	0.000

PROGRAM: 5209--COSMETOLOGY INSTITUTION TYPE: ALL INSTITUTION: ALL

WAGE MODEL: VARIABLE EMPLOYMENT

DESCRIPTION (PROGRAM AVERAGES)	SUBGROUP OF PROGRAM COMPLETERS			
	ALL COMPLETERS	COMPLETERS WITH VALID WAGE DATA	COMPLETERS IN JOB FOR WHICH TRAINED	COMPLETERS WITH VALID WAGE DATA AND IN JOB FOR WHICH TRAINED
NUMBER OF INDIVIDUALS	76	9	4	8
PRETRAINING SALARY	$1,284.99	$4,898.21	$1,305.31	$5,033.94
TRAINING PERIOD SALARY	$938.68	$2,485.40	$1,059.51	$2,643.99
POST-TRAINING SALARY	$2,047.04	$4,216.11	$2,088.09	$3,904.40
DIRECT PRIVATE COST	$197.82	$197.82	$197.82	$197.82
DIRECT PUBLIC COST	$1,910.63	$1,910.63	$1,910.63	$1,910.63
AGE	29	30	29	30
EXPECTED WORK YEARS	33	32	33	32
PRESENT VALUE OF LIFETIME SALARY				
WITHOUT TRAINING	$43,961.43	$160,678.60	$44,541.02	$165,131.13
WITH TRAINING	$66,137.37	$131,993.02	$67,595.24	$122,234.33
PRESENT VALUE OF LIFETIME TAXES				
WITHOUT TRAINING	$8,281.10	$29,609.54	$8,398.16	$30,697.52
WITH TRAINING	$13,172.79	$24,205.69	$12,379.35	$22,345.44
GROSS PRIVATE BENEFIT	$22,275.95	$-24,685.58	$23,054.23	$-42,866.80
NET PRIVATE BENEFIT	$18,434.25	$-23,081.72	$19,073.04	$-34,544.72
DIRECT PUBLIC BENEFIT	$3,841.69	$-5,603.86	$3,991.19	$-8,352.08
INDIRECT PUBLIC BENEFIT	$111,379.73	$-143,427.88	$115,271.13	$-214,484.01
TOTAL PUBLIC BENEFIT	$115,221.42	$-149,031.74	$119,262.32	$-222,836.09
PRIVATE COST	$517.53	$2,256.67	$412.84	$2,238.01
PUBLIC COST	$1,975.22	$2,388.13	$1,966.29	$2,387.36
PRIVATE BENEFIT-COST RATIO	35.620	-10.228	44.065	-15.435
DIRECT PUBLIC BENEFIT-COST RATIO	1.945	-2.347	2.033	-3.498
TOTAL PUBLIC BENEFIT-COST RATIO	58.334	-62.405	60.896	-93.340
PRIVATE RATE OF RETURN	126.100	0.000	154.000	0.000
DIRECT PUBLIC RATE OF RETURN	10.700	0.000	11.000	0.000
TOTAL PUBLIC RATE OF RETURN	195.800	0.000	203.400	0.000

PROGRAM: 3043--LICENSED PRACTICAL NURSING INSTITUTION TYPE: COMM COLL INSTITUTION: ALL

WAGE MODEL: FULL EMPLOYMENT

DESCRIPTION (PROGRAM AVERAGES)	SUBGROUP OF PROGRAM COMPLETERS			
	ALL COMPLETERS	COMPLETERS WITH VALID WAGE DATA	COMPLETERS IN JOB FOR WHICH TRAINED	COMPLETERS WITH VALID WAGE DATA AND IN JOB FOR WHICH TRAINED
NUMBER OF INDIVIDUALS	55	14	37	12
PRETRAINING SALARY	$6,199.11	$6,884.25	$6,229.90	$6,942.48
TRAINING PERIOD SALARY	$2,059.66	$2,506.47	$1,796.66	$2,252.81
POST-TRAINING SALARY	$7,322.18	$8,360.12	$7,914.01	$8,281.84
DIRECT PRIVATE COST	$972.00	$972.00	$972.00	$972.00
DIRECT PUBLIC COST	$4,000.00	$4,000.00	$972.00	$4,000.00
AGE	21	21	21	13
EXPECTED WORK YEARS	40	40	40	40
PRESENT VALUE OF LIFETIME SALARY				
WITHOUT TRAINING	$285,256.30	$316,834.62	$286,719.47	$319,514.78
WITH TRAINING	$299,970.20	$342,491.86	$324,215.90	$339,284.87
PRESENT VALUE OF LIFETIME TAXES				
WITHOUT TRAINING	$54,452.41	$61,271.94	$54,764.25	$61,859.37
WITH TRAINING	$57,606.64	$66,950.85	$62,893.01	$66,234.25
GROSS PRIVATE BENEFIT	$14,713.90	$25,657.24	$37,496.43	$19,770.10
NET PRIVATE BENEFIT	$11,559.68	$19,978.34	$29,367.67	$15,365.21
DIRECT PUBLIC BENEFIT	$3,154.22	$5,678.91	$8,128.76	$4,374.88
INDIRECT PUBLIC BENEFIT	$73,569.52	$128,286.22	$197,482.15	$98,850.49
TOTAL PUBLIC BENEFIT	$76,723.75	$133,965.13	$205,610.91	$103,225.37
PRIVATE COST	$4,624.93	$4,830.89	$4,868.79	$5,087.99
PUBLIC COST	$4,871.61	$4,947.71	$4,924.52	$5,006.14
PRIVATE BENEFIT-COST RATIO	2.499	4.136	6.032	3.026
DIRECT PUBLIC BENEFIT-COST RATIO	0.647	1.148	1.651	0.874
TOTAL PUBLIC BENEFIT-COST RATIO	15.749	27.076	39.722	20.620
PRIVATE RATE OF RETURN	11.900	17.400	23.200	13.700
DIRECT PUBLIC RATE OF RETURN	4.300	7.600	10.200	6.000
TOTAL PUBLIC RATE OF RETURN	46.400	79.500	112.800	62.400

PROGRAM: 3043--LICENSED PRACTICAL NURSING INSTITUTION TYPE: COMM COLL INSTITUTION: ALL

WAGE MODEL: VARIABLE EMPLOYMENT

DESCRIPTION (PROGRAM AVERAGES)	ALL COMPLETERS	SUBGROUP OF PROGRAM COMPLETERS: COMPLETERS WITH VALID WAGE DATA	SUBGROUP OF PROGRAM COMPLETERS: COMPLETERS IN JOB FOR WHICH TRAINED	SUBGROUP OF PROGRAM COMPLETERS: COMPLETERS WITH VALID WAGE DATA AND IN JOB FOR WHICH TRAINED
NUMBER OF INDIVIDUALS	55	14	37	12
PRETRAINING SALARY	$1,938.39	$4,150.92	$1,958.02	$4,032.60
TRAINING PERIOD SALARY	$2,059.66	$2,506.47	$1,706.66	$2,252.81
POST-TRAINING SALARY	$4,381.68	$6,293.17	$6,002.48	$6,375.79
DIRECT PRIVATE COST	$972.00	$972.00	$972.00	$972.00
DIRECT PUBLIC COST	$4,000.00	$4,000.00	$4,000.00	$4,000.00
AGE	21	21	21	21
EXPECTED WORK YEARS	40	40	40	40
PRESENT VALUE OF LIFETIME SALARY				
WITHOUT TRAINING	$89,210.94	$191,038.17	$90,574.54	$185,592.73
WITH TRAINING	$179,505.91	$257,814.30	$245,905.74	$248,909.22
PRESENT VALUE OF LIFETIME TAXES				
WITHOUT TRAINING	$16,311.03	$35,219.85	$16,551.37	$34,159.31
WITH TRAINING	$32,980.46	$49,678.48	$46,216.86	$46,835.18
GROSS PRIVATE BENEFIT	$90,294.97	$66,776.33	$155,331.20	$63,316.48
NET PRIVATE BENEFIT	$73,725.54	$53,317.70	$125,665.71	$50,640.61
DIRECT PUBLIC BENEFIT	$16,669.43	$13,458.63	$29,665.49	$13,675.87
INDIRECT PUBLIC BENEFIT	$451,474.85	$333,881.63	$776,655.93	$316,582.42
TOTAL PUBLIC BENEFIT	$468,144.28	$347,340.25	$806,321.43	$329,258.29
PRIVATE COST	$972.00	$2,521.08	$1,214.71	$2,628.22
PUBLIC COST	$3,999.91	$4,353.93	$4,051.24	$4,374.76
PRIVATE BENEFIT-COST RATIO	75.746	21.149	103.453	19.268
DIRECT PUBLIC BENEFIT-COST RATIO	4.167	3.091	7.323	2.937
TOTAL PUBLIC BENEFIT-COST RATIO	117.039	79.776	199.031	75.263
PRIVATE RATE OF RETURN	215.500	66.300	290.900	61.100
DIRECT PUBLIC RATE OF RETURN	17.500	14.900	27.400	14.200
TOTAL PUBLIC RATE OF RETURN	316.500	219.100	530.700	206.300

PROGRAM: 3047--LICENSED PRACTICAL NURSING INSTITUTION TYPE: AVC INSTITUTION: ALL

WAGE MODEL: FULL EMPLOYMENT

DESCRIPTION (PROGRAM AVERAGES)	ALL COMPLETERS	SUBGROUP OF PROGRAM COMPLETERS: COMPLETERS WITH VALID WAGE DATA	SUBGROUP OF PROGRAM COMPLETERS: COMPLETERS IN JOB FOR WHICH TRAINED	SUBGROUP OF PROGRAM COMPLETERS: COMPLETERS WITH VALID WAGE DATA AND IN JOB FOR WHICH TRAINED
NUMBER OF INDIVIDUALS	113	29	100	25
PRETRAINING SALARY	$5,852.19	$5,556.33	$5,761.34	$5,521.96
TRAINING PERIOD SALARY	$2,305.55	$2,116.49	$2,301.13	$2,018.92
POST-TRAINING SALARY	$6,991.74	$7,367.39	$6,966.72	$6,862.68
DIRECT PRIVATE COST	$241.79	$241.79	$241.79	$241.79
DIRECT PUBLIC COST	$4,709.19	$4,709.19	$241.79	$4,709.19
AGE	30	28	31	13
EXPECTED WORK YEARS	32	34	32	33
PRESENT VALUE OF LIFETIME SALARY				
WITHOUT TRAINING	$192,664.10	$197,307.15	$189,132.31	$189,483.92
WITH TRAINING	$219,364.38	$246,940.36	$218,782.48	$221,697.36
PRESENT VALUE OF LIFETIME TAXES				
WITHOUT TRAINING	$36,165.22	$37,016.19	$35,557.73	$35,333.52
WITH TRAINING	$41,894.36	$47,458.92	$41,765.84	$42,249.31
GROSS PRIVATE BENEFIT	$27,360.27	$40,633.21	$29,650.17	$33,208.44
NET PRIVATE BENEFIT	$21,571.14	$32,133.49	$23,442.05	$26,292.64
DIRECT PUBLIC BENEFIT	$5,739.14	$10,442.74	$6,209.11	$5,915.80
INDIRECT PUBLIC BENEFIT	$136,501.37	$248,166.06	$148,250.84	$166,042.18
TOTAL PUBLIC BENEFIT	$142,235.50	$258,608.80	$154,458.95	$172,957.97
PRIVATE COST	$3,225.06	$3,160.98	$3,153.12	$3,215.41
PUBLIC COST	$5,414.96	$5,393.88	$5,396.24	$5,402.28
PRIVATE BENEFIT-COST RATIO	6.689	12.367	7.436	8.177
DIRECT PUBLIC BENEFIT-COST RATIO	1.058	1.936	1.150	1.280
TOTAL PUBLIC BENEFIT-COST RATIO	26.266	47.945	28.623	32.016
PRIVATE RATE OF RETURN	28.400	46.200	31.000	33.200
DIRECT PUBLIC RATE OF RETURN	6.900	11.400	7.400	8.200
TOTAL PUBLIC RATE OF RETURN	92.900	159.700	100.500	109.700

PROGRAM: 3643--LICENSED PRACTICAL NURSING INSTITUTION TYPE: AVC INSTITUTION: ALL

WAGE MODEL: VARIABLE EMPLOYMENT

DESCRIPTION (PROGRAM AVERAGES)	ALL COMPLETERS	SUBGROUP OF PROGRAM COMPLETERS: COMPLETERS WITH VALID WAGE DATA	SUBGROUP OF PROGRAM COMPLETERS: COMPLETERS IN JOB FOR WHICH TRAINED	SUBGROUP OF PROGRAM COMPLETERS: COMPLETERS WITH VALID WAGE DATA AND IN JOB FOR WHICH TRAINED
NUMBER OF INDIVIDUALS	113	29	101	25
PRETRAINING SALARY	$1,477.76	$2,937.48	$1,323.25	$2,871.00
TRAINING PERIOD SALARY	$2,305.55	$2,116.49	$2,101.14	$2,019.92
POST-TRAINING SALARY	$3,583.16	$4,815.12	$3,416.81	$4,713.83
DIRECT PRIVATE COST	$241.79	$241.79	$241.79	$241.79
DIRECT PUBLIC COST	$4,709.19	$4,709.19	$4,709.19	$4,709.19
AGE	30	28	31	29
EXPECTED WORK YEARS	32	34	32	33
PRESENT VALUE OF LIFETIME SALARY				
WITHOUT TRAINING	$48,499.89	$103,955.91	$43,439.30	$97,999.74
WITH TRAINING	$112,577.63	$161,225.80	$119,863.01	$152,279.43
PRESENT VALUE OF LIFETIME TAXES				
WITHOUT TRAINING	$9,048.75	$13,939.19	$8,186.16	$17,823.41
WITH TRAINING	$20,526.58	$29,780.15	$21,894.68	$28,092.45
GROSS PRIVATE BENEFIT	$54,078.74	$57,269.89	$76,423.71	$54,279.69
NET PRIVATE BENEFIT	$52,600.92	$46,333.93	$52,715.19	$44,013.66
DIRECT PUBLIC BENEFIT	$11,477.82	$13,870.96	$13,709.51	$13,269.03
INDIRECT PUBLIC BENEFIT	$320,393.70	$286,349.47	$332,118.55	$271,398.46
TOTAL PUBLIC BENEFIT	$331,871.52	$297,220.43	$345,827.06	$284,667.50
PRIVATE COST	$241.79	$981.76	$241.79	$1,011.67
PUBLIC COST	$4,571.36	$4,873.66	$4,545.10	$4,876.48
PRIVATE BENEFIT-COST RATIO	217.550	47.261	259.381	43.503
DIRECT PUBLIC BENEFIT-COST RATIO	2.511	2.232	3.016	2.106
TOTAL PUBLIC BENEFIT-COST RATIO	72.598	61.023	87.089	57.760
PRIVATE RATE OF RETURN	753.100	159.800	895.500	152.600
DIRECT PUBLIC RATE OF RETURN	12.700	11.800	14.600	11.500
TOTAL PUBLIC RATE OF RETURN	247.100	197.100	294.800	193.400

FLORIDA DEPARTMENT OF EDUCATION
VOCATIONAL EDUCATION COST-BENEFIT SYSTEM
COMPUTATION OF COST-BENEFIT RATIOS AND RATES OF RETURN

PROGRAM: 9013--AIR CONDITIONING MECH | INSTITUTION TYPE: AVC | INSTITUTION: ALL

WAGE MODEL: FULL EMPLOYMENT

DESCRIPTION (PROGRAM AVERAGES)	SUBGROUP OF PROGRAM COMPLETERS: ALL COMPLETERS	COMPLETERS WITH VALID WAGE DATA	COMPLETERS IN JOB FOR WHICH TRAINED	COMPLETERS WITH VALID WAGE DATA AND IN JOB FOR WHICH TRAINED
NUMBER OF INDIVIDUALS	27	5	19	3
PRETRAINING SALARY	$6,727.73	$11,066.59	$6,252.01	$9,562.48
TRAINING PERIOD SALARY	$3,460.65	$9,463.02	$3,113.08	$3,917.45
POST-TRAINING SALARY	$8,162.62	$12,298.30	$8,063.26	$9,573.46
DIRECT PRIVATE COST	$128.00	$128.00	$123.00	$123.00
DIRECT PUBLIC COST	$2,681.19	$2,681.19	$139.03	$2,691.19
AGE	34	31	34	13
EXPECTED WORK YEARS	29	32	29	33
PRESENT VALUE OF LIFETIME SALARY				
WITHOUT TRAINING	$196,182.26	$363,633.93	$182,796.66	$292,243.95
WITH TRAINING	$211,580.04	$386,959.73	$229,847.01	$309,597.26
PRESENT VALUE OF LIFETIME TAXES				
WITHOUT TRAINING	$37,419.23	$75,193.07	$34,574.94	$57,904.01
WITH TRAINING	$45,115.50	$81,010.05	$44,739.10	$61,413.16
GROSS PRIVATE BENEFIT	$35,397.77	$13,319.43	$47,000.34	$17,353.32
NET PRIVATE BENEFIT	$27,701.50	$7,402.82	$36,961.17	$13,344.17
DIRECT PUBLIC BENEFIT	$7,696.27	$5,836.98	$10,129.17	$4,009.14
INDIRECT PUBLIC BENEFIT	$176,983.86	$116,593.99	$235,451.71	$86,766.58
TOTAL PUBLIC BENEFIT	$184,680.12	$122,430.98	$245,580.88	$90,775.72
PRIVATE COST	$2,819.13	$2,313.28	$2,725.07	$4,001.85
PUBLIC COST	$3,349.95	$3,354.55	$3,313.27	$3,703.87
PRIVATE BENEFIT-COST RATIO	9.826	7.549	13.563	3.334
DIRECT PUBLIC BENEFIT-COST RATIO	2.297	1.746	3.057	1.083
TOTAL PUBLIC BENEFIT-COST RATIO	55.132	36.504	74.129	24.528
PRIVATE RATE OF RETURN	42.400	31.300	56.200	16.000
DIRECT PUBLIC RATE OF RETURN	15.200	11.500	18.900	8.300
TOTAL PUBLIC RATE OF RETURN	204.800	125.100	271.900	85.000

PROGRAM: 9011--AIR CONDITAT MECH INSTITUTION TYPE: AVC INSTITUTION: ALL

WAGE MODEL: VARIABLE EMPLOYMENT

DESCRIPTION (PROGRAM AVERAGES)	ALL COMPLETERS	SUBGROUP OF PROGRAM COMPLETERS: COMPLETERS WITH VALID WAGE DATA	COMPLETERS IN JOB FOR WHICH TRAINED	COMPLETERS WITH VALID WAGE DATA AND IN JOB FOR WHICH TRAINED
NUMBER OF INDIVIDUALS	27	5	19	3
PRETRAINING SALARY	$2,346.11	$9,873.10	$1,590.93	$6,573.33
TRAINING PERIOD SALARY	$3,469.65	$8,463.02	$3,110.08	$3,917.45
POST-TRAINING SALARY	$5,345.69	$10,859.84	$5,934.68	$9,127.57
DIRECT PRIVATE COST	$128.00	$128.00	$128.00	$128.00
DIRECT PUBLIC COST	$2,681.19	$2,681.19	$2,681.19	$2,681.19
AGE	34	31	34	29
EXPECTED WORK YEARS	29	32	29	33
PRESENT VALUE OF LIFETIME SALARY				
WITHOUT TRAINING	$69,413.32	$324,414.57	$46,515.57	$224,352.53
WITH TRAINING	$151,661.39	$341,969.49	$169,203.31	$295,177.55
PRESENT VALUE OF LIFETIME TAXES				
WITHOUT TRAINING	$12,469.89	$65,633.51	$8,642.06	$42,808.37
WITH TRAINING	$28,222.48	$69,811.78	$31,760.83	$58,476.73
GROSS PRIVATE BENEFIT	$43,248.37	$17,594.92	$122,684.74	$70,825.03
NET PRIVATE BENEFIT	$37,495.48	$13,325.64	$99,559.98	$55,156.67
DIRECT PUBLIC BENEFIT	$15,752.58	$4,228.28	$23,124.77	$15,669.35
INDIRECT PUBLIC BENEFIT	$416,240.33	$87,774.59	$613,423.72	$354,125.13
TOTAL PUBLIC BENEFIT	$431,992.91	$92,002.87	$636,548.49	$369,793.48
PRIVATE COST	$128.00	$1,347.59	$128.00	$2,401.93
PUBLIC COST	$2,493.29	$3,059.23	$2,415.42	$3,251.91
PRIVATE BENEFIT-COST RATIO	327.308	9.604	777.812	22.964
DIRECT PUBLIC BENEFIT-COST RATIO	6.343	1.382	9.574	4.818
TOTAL PUBLIC BENEFIT-COST RATIO	173.240	30.074	263.536	113.716
PRIVATE RATE OF RETURN	1990.300	34.500	2915.400	83.100
DIRECT PUBLIC RATE OF RETURN	27.200	3.800	37.300	25.100
TOTAL PUBLIC RATE OF RETURN	636.900	104.300	956.900	371.100

PROGRAM: 9205--COSMETOLOGY INSTITUTION TYPE: AVC INSTITUTION: ALL

WAGE MODEL: FULL EMPLOYMENT

DESCRIPTION (PROGRAM AVERAGES)	ALL COMPLETERS	SUBGROUP OF PROGRAM COMPLETERS: COMPLETERS WITH VALID WAGE DATA	SUBGROUP OF PROGRAM COMPLETERS: COMPLETERS IN JOB FOR WHICH TRAINED	SUBGROUP OF PROGRAM COMPLETERS: COMPLETERS WITH VALID WAGE DATA AND IN JOB FOR WHICH TRAINED
NUMBER OF INDIVIDUALS	76	9	64	8
PRETRAINING SALARY	$6,086.76	$7,633.25	$6,154.15	$7,914.82
TRAINING PERIOD SALARY	$939.64	$2,485.40	$1,059.51	$2,643.99
POST-TRAINING SALARY	$5,971.64	$5,334.37	$5,916.92	$6,123.70
DIRECT PRIVATE COST	$197.82	$197.82	$197.82	$197.82
DIRECT PUBLIC COST	$1,913.63	$1,910.63	$197.82	$1,913.63
AGE	29	30	29	33
EXPECTED WORK YEARS	33	32	31	32
PRESENT VALUE OF LIFETIME SALARY WITHOUT TRAINING	$207,761.84	$252,037.70	$210,045.67	$259,634.19
PRESENT VALUE OF LIFETIME SALARY WITH TRAINING	$192,933.45	$197,996.14	$191,341.54	$191,713.68
PRESENT VALUE OF LIFETIME TAXES WITHOUT TRAINING	$39,315.07	$49,026.33	$39,788.16	$50,695.03
PRESENT VALUE OF LIFETIME TAXES WITH TRAINING	$36,237.37	$37,432.75	$35,991.40	$35,100.43
GROSS PRIVATE BENEFIT	$-14,959.98	$-54,041.56	$-18,504.13	$-67,920.51
NET PRIVATE BENEFIT	$-11,782.28	$-43,437.97	$-14,471.37	$-53,325.31
DIRECT PUBLIC BENEFIT	$-3,077.70	$-11,633.52	$-3,832.75	$-14,594.60
INDIRECT PUBLIC BENEFIT	$-74,299.92	$-270,237.78	$-92,520.64	$-339,602.53
TOTAL PUBLIC BENEFIT	$-77,377.62	$-281,811.35	$-96,353.40	$-354,197.13
PRIVATE COST	$4,528.97	$4,515.12	$4,479.05	$4,569.90
PUBLIC COST	$2,907.50	$2,904.97	$2,903.37	$3,009.02
PRIVATE BENEFIT-COST RATIO	-2.602	-3.399	-3.276	-11.669
DIRECT PUBLIC BENEFIT-COST RATIO	-1.059	-3.887	-1.321	-4.850
TOTAL PUBLIC BENEFIT-COST RATIO	-26.613	-96.413	-33.221	-117.712
PRIVATE RATE OF RETURN	0.000	0.000	0.000	0.000
DIRECT PUBLIC RATE OF RETURN	0.000	0.000	0.000	0.000
TOTAL PUBLIC RATE OF RETURN	0.000	0.000	0.000	0.000

PROGRAM: 9205--COSMETOLOGY INSTITUTION TYPE: AVC INSTITUTION: ALL

WAGE MODEL: VARIABLE EMPLOYMENT

DESCRIPTION (PROGRAM AVERAGES)	ALL COMPLETERS	SUBGROUP OF PROGRAM COMPLETERS: COMPLETERS WITH VALID WAGE DATA	SUBGROUP OF PROGRAM COMPLETERS: COMPLETERS IN JOB FOR WHICH TRAINED	SUBGROUP OF PROGRAM COMPLETERS: COMPLETERS WITH VALID WAGE DATA AND IN JOB FOR WHICH TRAINED
NUMBER OF INDIVIDUALS	76	9	64	8
PRETRAINING SALARY	$1,284.99	$4,898.21	$1,305.01	$5,033.94
TRAINING PERIOD SALARY	$938.69	$2,485.40	$1,059.51	$2,643.99
POST-TRAINING SALARY	$2,047.04	$4,216.11	$2,038.09	$3,904.40
DIRECT PRIVATE COST	$197.82	$197.82	$197.82	$197.82
DIRECT PUBLIC COST	$1,910.63	$1,910.63	$1,910.63	$1,910.63
AGE	29	30	29	30
EXPECTED WORK YEARS	33	32	33	32
PRESENT VALUE OF LIFETIME SALARY				
WITHOUT TRAINING	$43,861.43	$160,678.60	$44,541.02	$165,131.13
WITH TRAINING	$66,137.37	$131,993.02	$67,595.24	$122,234.33
PRESENT VALUE OF LIFETIME TAXES				
WITHOUT TRAINING	$8,281.10	$29,809.54	$8,398.16	$30,697.52
WITH TRAINING	$12,122.79	$24,205.69	$12,379.35	$22,345.44
GROSS PRIVATE BENEFIT	$22,275.95	$-24,685.58	$23,054.23	$-42,896.80
NET PRIVATE BENEFIT	$18,434.25	$-23,091.72	$19,073.04	$-34,544.72
DIRECT PUBLIC BENEFIT	$3,841.69	$-5,603.86	$3,981.19	$-8,352.08
INDIRECT PUBLIC BENEFIT	$111,379.73	$-143,427.88	$115,271.13	$-214,484.01
TOTAL PUBLIC BENEFIT	$115,221.42	$-149,031.74	$119,252.32	$-222,836.09
PRIVATE COST	$517.53	$2,256.67	$432.84	$2,238.01
PUBLIC COST	$1,975.22	$2,333.13	$1,958.29	$2,387.36
PRIVATE BENEFIT-COST RATIO	35.620	-10.228	44.065	-15.435
DIRECT PUBLIC BENEFIT-COST RATIO	1.945	-2.347	2.033	-3.498
TOTAL PUBLIC BENEFIT-COST RATIO	58.334	-62.405	60.896	-93.340
PRIVATE RATE OF RETURN	126.100	0.000	154.000	0.000
DIRECT PUBLIC RATE OF RETURN	10.700	0.000	11.000	0.000
TOTAL PUBLIC RATE OF RETURN	195.800	0.000	203.400	0.000